THE ILLUMINATING ENGINEER

LIGHT LAMPS FITTINGS AND ILLUMINATION

THE JOURNAL OF GOOD LIGHTING

OIL . GAS ELECTRICITY ACETYLENE PETROL-AIR GAS ETC.

OFFICIAL ORGAN of
The Illuminating Engineering Society
(Founded in London, 1909; Incorporated 1930)
and of
THE ASSOCIATION OF PUBLIC LIGHTING ENGINEERS
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Special Features:

International Illumination Congress—Lighting of Schools and Libraries—Public Lighting in Tokyo—Modern Street Lighting by Gas—Lighting Literature—News from Abroad, etc.

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Edited by J. STEWART DOW

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The Lighting of Schools and Libraries

READERS will recall that in our last issue* we reproduced the reports issued by the joint sub-committees formed by the Technical Committee of the Illuminating Engineering Society to deal with the lighting of schools and libraries. The task of these sub-committees was to revise the original reports on these subjects issued in 1913-1914. We think it will be agreed that the work has been well done, and it is an achievement for the newly formed Technical Committee to have brought the investigations to this successful issue.

Before commenting in detail on the recommendations embodied in these reports it may be well to consider just what can be expected from such committees. In the first place, they can only *recommend* -their findings have no binding power in the sense of a legal enactment. Recommendations can go further and can be more explicit than orders or rules, which may form the basis of legal action. Yet it would not be wise to assume that "ideal" conditions of school or library lighting must necessarily be framed: for the recommendations are intended as a guide to laymen as well as experts, who would tend to lose interest if it was apparent that these ideal conditions could never, or hardly ever, be complied with in practice. From this standpoint it is surely better to propose methods which represent "good modern practice." The general adoption of such methods should result in an all-round advance in school and library lighting, yet their adoption should not appear too formidable. An officer or committee studying the report should feel that the demands are not unreasonable, and could be satisfied with advantage and without extravagant expense. "Standards" of lighting proposed on this basis are naturally not intended to be final or rigid. They may need modification as our knowledge and implements improve, and they should be regarded as a temporary structure which may be replaced hereafter by something more durable and imposing. This, we imagine, conveys a fair impression of the outlook underlying these recommendations, which should serve as a useful guide at the present time.

Turning first to the report on natural lighting in schools, we find that it crystallizes and puts in a more concise form the ideas developed in the original somewhat lengthy report of 1914. One of the chief points is the recognition that the study of access of daylight must be based on relative measurements, i.e., on the "daylight factor." Absolute measurements of daylight in interiors, which vary even from minute to minute, are of little value. Even empirical rules connecting window space and floor area, etc., may now be regarded as obsolete. The essential guide is the "daylight factor," which in several circumstances should not be less than 0.5 per cent., but may, in exceptional circumstances—such as the erection of schools to new designs on sites favourable to access of daylight—attain 1 per cent. (We have here a good example of the contrast between what is practical and what is ideal.)

In the reports on artificial lighting of schools and libraries attention is devoted primarily to such fundamental criteria of good lighting as sufficiency of illumination and absence of glare or troublesome shadows. The suggestion in regard to glare and shadows should meet with general approval.

Certainly the adoption of the recommendations would go far to eliminate any serious trouble from glare in practice. It should, of course, be realized that "glare" is a subjective impression varying very greatly with different persons. But there must be few cases in which a properly situated lighting unit with a brightness of the order of, say, 5 candles per square inch can give rise to appreciable glare.

The most difficult problem, undoubtedly, has been the fixing of a desirable minimum illumination. The value assigned (5 foot-candles) represents a considerable advantage beyond the figure in the original report, especially when the remarks in regard to depreciation of lighting installations are borne in mind. It is doubtless justified by the great improvement that has taken place in our facilities for providing light since 1914, and by the recognition that at the present time the general standard of lighting has advanced so greatly that an interior receiving much less would appear underlighted. At the same time, we still lack satisfactory demonstration of the drawbacks of lower illuminations in schools, such as would give this recommendation a scientific basis. We understand that this fundamental problem is now being taken up and the necessary experimental work initiated. An enquiry into this subject would naturally require time, and might well prove a complicated and difficult one. We believe, however, that it might lead to exceedingly valuable results, and that it is well worth the patience demanded.

* *Illum. Eng., July,* 1931, pp. 155-161.

The International Illumination Congress, 1931

ALTHOUGH there is yet a month before the International Illumination Conference opens, it may be assumed that arrangements are practically completed, as is illustrated by the detailed programme and list of papers which appear on pp. 179-184.

It will be seen that visitors will have a wide choice of entertainments during their stay in London, before the commencement of the technical sessions in other cities. One of the most interesting features of this programme will undoubtedly be the floodlighting of numerous public buildings—a new and important departure. It is not every day that the privilege of lighting up such buildings as the Houses of Parliament, Buckingham Palace, and the National Gallery is granted!

In Continental cities, where "festivals of light" are quite usual, the illumination of public buildings is a more familiar feature, but the application of floodlighting on this scale in London is a noteworthy event, which must surely lead to future developments. We regard such demonstrations as of great importance in aiding one of the chief objects of the Congress—the awakening of public interest in illumination. The primary intention of an international gathering such as this is naturally to promote interchange of thought and cordial relations between experts from different countries. We have no doubt that the Congress will be of great benefit in this direction, but we trust and believe that it will also have the effect of raising the status of illumination in this country, rendering the task of advocates of better lighting easier in years to come.

The series of papers, over 150 in number, covers a wide range. We know that the allocation of papers to each centre has been the subject of much careful study, with the result that the programmes in each city have been judiciously balanced, the more purely technical subjects being supplemented in each instance by accounts of developments and applications of light. By visiting in succession Glasgow, Edinburgh, Buxton, Sheffield and Birmingham, delegates will gain a fair impression of British cities, and the subsequent tour to Stratford-on-Avon will form a break before the sessions of the International Commission on Illumination at Cambridge begin. An interesting feature at Cambridge will be the lecture promised by Sir Arthur Eddington. Amongst the topics to be discussed at technical sessions are: Natural lighting, nomenclature, coloured signal glasses, heterochromatic photometry, and the lighting of streets, schools and factories.

Even the conclusion of the Conference at Cambridge, on September 19th, will not end the festivities of this noteworthy September. For September 21st, the Faraday Centenary celebrations open, and on September 23rd General Smuts is to deliver the Presidential Address to the British Association—which this year celebrates the centenary of its foundation on September 26th, 1831.

We shall have more to say regarding the Congress in our next issue, but meantime we take the opportunity of joining in advance in the welcome to the delegates from all over the world, who by that time will have assembled in this country.

Illumination is becoming more and more an "international" subject, and we feel sure that nothing but good can come of this opportunity for interchange of thought between experts from different lands.

Street Lighting in Tokyo

THE contribution which Mr. Tōru Kashiki has sent us (see p. 183) is an interesting survey of the development of street lighting in far-away Japan. It is not surprising—Japan being a country with little coal and abundant water power—to find that the public lighting is now mainly electrical, though other illuminants still serve many of the streets.

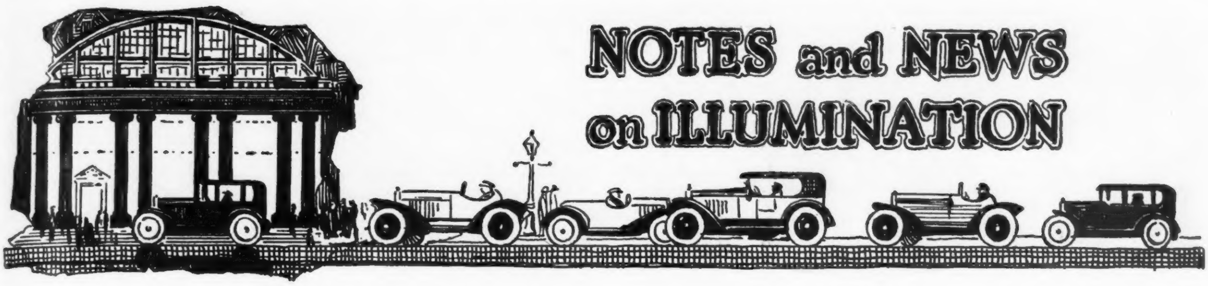
The lighting of Tokyo, however, is rendered interesting by two chief factors—the special devices characteristic of a transition from Eastern to Western methods, and the remarkable extent to which public lighting is still done by private contributions. As regards the first question, we may hazard the hope that, in modernizing the lighting of Japanese cities, as much as possible of the atmosphere of old Japan and its characteristic art will be preserved. The need for the preservation of ancient Japanese lighting fittings was illustrated in the wonderful work presented by Dr. Tōru Motono, to which we alluded in our last issue.

As regards the second point, one can but wonder at the singular position that seems to have developed in Tokyo, where so much that is really public lighting still rests in private hands. In Great Britain, as in most other countries, street lighting was originally a duty imposed on each individual householder. Gradually street lighting came to be regarded as a public duty, payable out of the rates: such lighting as is now undertaken and paid for by private persons is not regarded as contributing to the illumination of streets—though in fact it is often not without value. In the United States, as Mr. Grant Mackenzie's recent paper showed, there is a tendency to rely much more on subscriptions from merchants and other private persons to defray the cost of street lighting, with the result that business thoroughfares are often illuminated with great brilliancy.

In America, supervision evidently secures that such supplementary private lighting is reasonably well adapted to the practical needs and artistic requirements of streets. In Tokyo, on the other hand, it would seem that "private lighting" in some thoroughfares has been allowed to develop almost unchecked; and the position has now become difficult, as people who pay for lights outside their premises instal what appeals to them rather than what the public needs.

No doubt the removal of such anomalies is only a question of time. But meanwhile the correlation of public and private lighting in streets is becoming a question of importance in most large cities. Such private exterior lighting is mainly for purposes of publicity. It should not be allowed to become too unsightly, but, if wisely administered, it may be of genuine public utility, supplementing the public lighting and enhancing the appearance of a city by night.

We have pointed out on previous occasions how the conception of "public lighting" tends to extend continually. Already we have added to the primary duty of illuminating streets the provision of luminous traffic-control signals and illuminated direction signs, both for the guidance of vehicles and as an aid to pedestrians. Already there is a tendency to deprecate the multiplication of brilliant advertising signs in the vicinity of traffic signals. Both in busy streets and on arterial roads some degree of control may become necessary, and this may ultimately be applied to all forms of exterior lighting in specially important areas.



Industrial Health Research Board

ELEVENTH ANNUAL REPORT

The Eleventh Annual Report of the Industrial Health Research Board, now available, includes an analysis of work published during the period 1926-30. The analysis illustrates the wide field of operations of the Board, and the many useful researches it has initiated bearing on the health and well-being of industrial workers. Of special interest to our readers are the researches on lighting, amongst which the now famous enquiry conducted by Mr. H. C. Weston and Mr. A. K. Taylor on the effect of different lighting conditions on the output and accuracy of hand-composing is mentioned. Equally interesting are the investigations of Mr. H. C. Weston and Mr. S. Adams into the influence of lighting conditions on rougher varieties of work, such as that undertaken by women tile pressers. In this case the effect of better lighting on output would presumably be less, but even here an increase from 1.7 to 4.7 foot-candles of artificial light led to an increase in output of 6 per cent., while a further 6 per cent. increase was recorded when the workers operated under good daylight illumination. Experiments on this problem are still proceeding. Heating and ventilation have been studied with special care. Other topics treated in past publications are hours of work and rest pauses, physiological processes involved in work, and vocational selection and guidance. Amongst matters dealt with during the past year may be mentioned miners' lamps, the effects of ultra-violet radiation, and the influence of noise and vibration. In connection with miners' lamps attention is drawn to the glare from bare filaments which may be lessened by painting one-third of the outer well glass with white enamel.

Watling Street Reconstruction

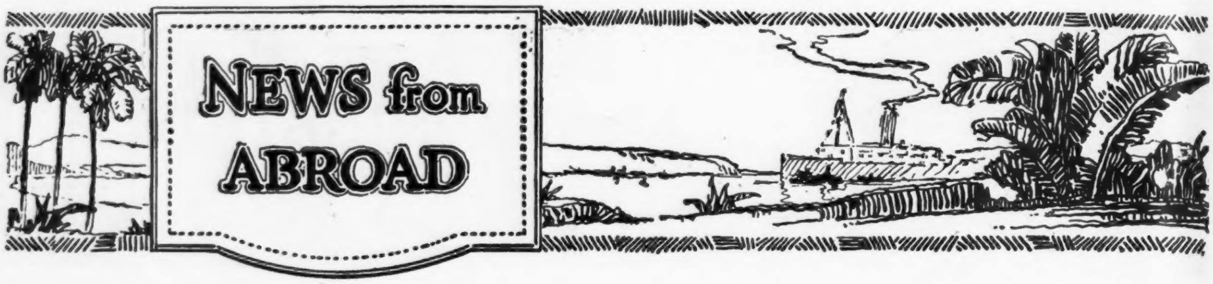
We observe in *Municipal Engineering* an account of the reconstruction of Watling Street, the historic thoroughfare consisting of the line of highways between London, the Midlands and Holyhead. Widening and strengthening of the roadway has become imperative, and in 1929 the work of reconstruction now in hand and estimated to cost £271,890 was approved. Of this sum the Ministry of Transport is contributing 85 per cent. A census, carried out near Dunstable, has shown an average daily volume of traffic of 3,771 vehicles weighing 12,413 tons. It is pointed out, however, that had the census been confined to the period 6 a.m. to 10 p.m. the average daily weight would have been 82 per cent. of the total. This statement is interesting because it suggests that arterial roads tend to be overworked during these 14 hours, but carry little during the remaining eight. If road traffic could be spread in relation to time the wear on the road could be lessened. Proper lighting, one is inclined to think, would be a help in this direction, and it may fairly be argued that a highway on which nearly £300,000 is being spent deserves to be well lighted!

The Faraday Centenary Celebrations

The Faraday Centenary Celebrations which commence on September 21st are being arranged jointly by the Royal Institution and the Institution of Electrical Engineers. So far as possible, arrangements have been made to avoid the two series of events clashing. The chief item, the Faraday Exhibition at the Royal Albert Hall, is to remain open from September 23rd to October 3rd. The exhibition will be formally opened on September 23rd by the Rt. Hon. J. C. Smuts, who will deliver his Presidential Address to the British Association on the same evening. A conference arranged by the Institution will take place in the Kingsway Hall on September 22nd, when conversaziones both of the Royal Institution and the I.E.E. will take place. Another agreeable event is the garden party at the National Physical Laboratory arranged by the Royal Institution for September 24th. A large influx of foreign visitors is expected, and it is probable that many of those who take part in the International Illumination Congress will remain to attend the Faraday celebrations. We understand that the display at the Faraday Exhibition will prove well worth seeing. We have no doubt that many of our readers will desire to witness this unique record of the work of one of the greatest of British discoverers.

Illuminated Signs

In a recent contribution to *Electrical Industries* Mr. John Langdon gives some striking figures regarding the development of illuminated signs in the United States. It is not merely that illuminated signs attain huge dimensions in American cities—a development which we may not all wish to imitate. What is much more striking is the readiness of people in comparatively small cities to spend money in this way. Mr. Langdon mentions, as an instance, Port Clinton, a small town in America with a population of only 3,400. In this small town (one might almost say village) 22 signs averaging in value £72,10s. each were sold during 1929. It is doubtful whether there is any town of similar size in England where the total connected value of electric signs would reach £200! The possibilities of the illuminated sign as a means of giving information have only recently come to be partially appreciated by the railways, and they have probably many other applications unsuspected as yet. Mr. Langdon mentions that every £100 capital invested in a sign affords an annual revenue of £25 to the supply undertakings—who should surely encourage this form of publicity! Illuminated signs at the present time form one of the most interesting sections of the lighting field. They are in a state of constant development, interesting features being the tendency to form combinations of incandescent lamps and neon tubes, and the creation of more life-like and elaborate "animated" effects. Moreover, the applications of signs are constantly extending, so that advertising now forms only one of many purposes which they serve.



Impressions of Lighting in Europe and America

In an address recently delivered before the N.S.W. sections of the Australian Illuminating Engineering Society, Mr. W. S. Corner summarized the impressions received during a recent visit to Europe and the United States. Generally speaking, he thinks that installations for which Australian lighting experts are responsible compare well with those abroad. But the comparative isolation of Australia is naturally rather a drawback. He emphasizes the growing recognition that high-intensity illumination, in order to be of real service, must be free from glare. In street lighting, however, glare is still far more prevalent than it should be. The gas undertakings in Great Britain he finds to be well organized, but he suggests that the tendency for combinations of gas and electrical concerns, evident in the United States, might with advantage extend to Great Britain. As a particularly good example of decorative interior lighting Mr. Corner mentions the roof-panel lighting in the Kroll Opera House, Berlin, where the World Power Conference was held. Many good installations in hotels and restaurants were seen, but he names the lighting of the dining-room in one Sydney restaurant as being the equal of any. Other things that awakened Mr. Corner's interest were the famous bridges in Great Britain and America (especially the brilliantly illuminated mile-long bridge at Schenectady), the general development of luminous traffic signals (at present little used in Australia), and the numerous illuminated fountains seen. Many of those in the United States are the gifts of prominent citizens and illustrate the civic pride characteristic of American cities.

Progress in France

Under the auspices of the *Association des Ingenieurs de l'Eclairage* a considerable amount of useful work is evidently being done by a series of committees concerned with such matters as the specifications for enamelled reflectors, fittings and photometric accuracy. In connection with the latter subject various forms of illumination-photometers have been presented and discussed and the various sources of error analysed, special attention being paid to the possible discrepancies caused by shadows of the body of the observer on the test-plate. Another section deals with the study of diffusing surfaces commonly employed in architecture, and their relation to "architectural lighting" schemes. This is a topic of considerable interest and complexity. The Committee has made a start by tabulating in diagrammatic form the various problems and calculations involved. Such questions as the dimensions of screens necessary to conceal sources of light, the variation in brightness permissible on an illuminated plane surface, and the limits of brightness desirable from the physiological aspect are being examined. For this information we are indebted to *Lux* (May, 1931, pp. 79-80).

Street Lighting and Traffic Accidents

A new method of studying the above question is revealed in a recent contribution by Mr. K. M. Reid,* whose experiments were conducted mainly in Cleveland, U.S.A. The method is based on the comparison of night and day accidents. Take for example four roads in this city, two well lighted and two badly lighted. The day accidents on the former were greater in number than on the latter streets, but the night accidents were *less*. Furthermore, when the poor lighting was improved the number of night fatalities progressively diminished. Whilst this experience was interesting the number of fatal accidents involved (in no case more than 8 per annum) seems too small to serve as a really satisfactory guide. But this objection cannot be said to apply to Mr. Reid's next enquiry, which covered a considerable number of streets on which as many as 69 fatal accidents occurred by night. We cannot reproduce the author's calculations, but his conclusion was roughly as follows: "On the poorly lighted thoroughfares there were 81 per cent. more fatalities by night than by day, whereas on the well-lighted thoroughfares there were only 19 per cent. more fatalities by night than by day. Hence about 35 per cent. of the night-traffic accidents might have been avoided by proper street lighting." A survey of the Indiana State roads has independently led to the conclusion that "the night hazard is about four times the day hazard," and Mr. S. J. Williams, director of the National Safety First Council, after analysing data for four typical States infers that 35 per cent. of night-traffic accidents are directly or indirectly attributable to lack of illumination.

Decorative Lighting in England, Holland and Austria

It is interesting to observe how quickly interesting developments in lighting are now broadcasted. We have previously alluded to the illustrated descriptions of lighting installations appearing in *Ljuskulturs Manadsblad*—a Swedish publication. A recent issue contains a description of some attractive installations in Holland and England. Some effective concealed lighting in a music studio in Amsterdam is shown, whilst Rotterdam and The Hague are represented by unusual exterior lighting of stores and factories, by means of boldly executed luminous lines and strips of the variety now popular abroad. In England the author has picked out the exterior lighting of Selfridge's, the "lily" pedestal lighting units on the Piccadilly Circus underground station, novel interior lighting at Austin Reed's, and the new Lyons' Corner House. In another issue of the same journal, which is evidently on the alert for foreign news, we find that more than half a page is devoted to a notice of the International Illumination Congress. Other examples of spectacular lighting, this time in Austria, are to be found in a recent issue of *Die Lichttechnik*. Illuminated canopies over stores resemble those now becoming usual in England and liberal use is made of luminous pillars and columns in so-called "light architecture."

* *Elec. World*, June 20th, 1931, pp. 1186-1188.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

The International Illumination Congress, 1931

(To take place in Great Britain during September 1st—19th, 1931.)

THE time is drawing near to the opening of the International Illumination Congress which takes place in this country during September 1st to 19th. In what follows we give a summary of the entire programme and also a provisional list of the papers to be presented, which cover a wide ground.

As we go to press we have also received a copy of the detailed local programme for London. The presentation of papers only commences at Glasgow on September 4th. The period September 1st to 3rd in London is given up to visits and social events, and should prove an entertaining prelude to the more serious work that follows.

On September 1st visits to the Gas Light and Coke Co., the E.L.M.A. Lighting Service Bureau, and to various power stations and Greenwich Observatory are arranged. At 12-30 p.m. there will be an official luncheon at the Savoy Hotel. The most interesting event, however, will be the river trip in the evening from Greenwich to the Tower of London, and hence to Westminister, when the floodlighting of Big Ben, Somerset House, County Hall, Buckingham Palace, the National Gallery, and the flower-beds in St. James's Park, etc., will be witnessed. (We may mention that both gas and electricity are being used for floodlighting demonstrations.) These lighting displays, which are being prepared on an unprecedented scale, should be witnessed by everyone who can possibly do so. Similar displays are also being arranged in many of the other cities visited.

On September 2nd and on September 3rd there are other visits to the Houses of Parliament and Westminster Abbey, to Windsor Castle and the Watt Physical Laboratory, to Watson House and the G.E.C. Research Laboratories, and to the Holophane Demonstration Theatre at Wembley and to typical modern lighting installations (such as the Strand Palace and Dorchester Hotels, the Imperial Chemical Industries Building, the Home Office Industrial Museum, etc.). There will be an official Banquet at the Dorchester Hotel at 8 p.m. on September 2nd, to be followed by an exhibit of aerodrome and aircraft lighting at Croydon Aerodrome and a tour of inspection with the object of studying the street lighting in London.

Visitors have thus a most varied and entertaining programme before them. In what follows we reproduce the official programme for the entire tour:—

Outline of Programme

TUESDAY, 1ST SEPTEMBER. LONDON.

Morning. Attendance at Reception Bureau. Alternative visits to places of interest in neighbourhood, including technical visits arranged by the Gas and Electric Companies.

Afternoon and Evening. Trip to Port of London, returning to Tower of London and Westminster by river, to see illuminated buildings on riverside, including technical visits during the afternoon.

Visit to street and shop lighting and illuminated public buildings.

WEDNESDAY, 2ND SEPTEMBER.

Morning. Visits to places of interest in London, with alternative technical visits.

Afternoon. Technical visits with alternative trip to Windsor Castle and Hampton Court.

Evening. Internal cathedral lighting. Store and street lighting.

THURSDAY, 3RD SEPTEMBER.

Morning. Visits to places of general interest and alternative technical visits.

Afternoon. By train to GLASGOW. (Luncheon, tea and dinner on train.)

FRIDAY, 4TH SEPTEMBER.

Morning and Afternoon. Technical Sessions at the Royal Technical College. (Alternative visits of interest for ladies and those not attending the Sessions.)

Evening. Reception by the Lord Provost and Council in the City Chambers; inspection of the street lighting of the city.

SATURDAY, 5TH SEPTEMBER.

Boat excursion on the Firth of Clyde.

SUNDAY, 6TH SEPTEMBER.

By train to EDINBURGH.

MONDAY, 7TH SEPTEMBER.

Morning and Afternoon. Technical Sessions of the Congress, in conjunction with the Annual Conference of the Association of Public Lighting Engineers, at the University of Edinburgh. (Alternative visits of interest for ladies and those not attending the Sessions.)

Evening. Reception by the Lord Provost and Council, followed by a dance at the Edinburgh College of Art; inspection of the street lighting of the city.

TUESDAY, 8TH SEPTEMBER.

Morning. Annual Meeting of the Association of Public Lighting Engineers. Motor trip and visits within the city.

Afternoon. By train to BUXTON.

Evening. Arrive Buxton.

WEDNESDAY, 9TH SEPTEMBER.

Morning. By road to SHEFFIELD. Reception and luncheon by the Lord Mayor and City Corporation, and the Sheffield Gas Company.

Afternoon. Alternative visits of technical and general interest.

Evening. By road to BUXTON.

THURSDAY, 10TH SEPTEMBER.

Morning and Afternoon. Technical Sessions. (Alternative visits of interest for ladies and those not attending the Sessions.)

Evening. By train to BIRMINGHAM.

FRIDAY, 11TH SEPTEMBER.

Morning and Afternoon. Technical Sessions. (Alternative visits of interest for ladies and those not attending the Sessions.)

Evening. Reception by the Lord Mayor and Council, followed by a dance.

SATURDAY, 12TH SEPTEMBER.

Whole day motor-coach tour to Stratford-on-Avon and the Shakespeare Country.

SUNDAY, 13TH SEPTEMBER.

By train to CAMBRIDGE.

SUNDAY, 13TH SEPTEMBER, TO FRIDAY, 18TH SEPTEMBER.

Plenary Sessions and Meetings of the International Commission on Illumination in Trinity College (by the courtesy of the College Council).

Demonstration of Automobile Lighting to be given with the co-operation of the Royal Automobile Club.

A lecture will be given one evening during this period by Sir Arthur Eddington, D.Sc., F.R.S.

Arrangements are being made for tours of the Colleges, and visits of interest during this period for ladies and those not attending meetings.

SATURDAY, 19TH SEPTEMBER.

By train to LONDON.

MONDAY, 21ST SEPTEMBER.

Opening of Faraday Centenary Celebrations.

Allocation of Papers

FRIDAY, 4TH SEPTEMBER. **GLASGOW.**

Morning Session, 10.0 *a.m.*

Section 1. ***Lighting Developments***

47. Ueber die Brauchbarkeit von Modellen bei Lichttechnischen Vorführungen. O. HÖPKE (*Germany*).

61. Organisation for the Development of Electric Lighting. C. A. ATHERTON (*Phœbus*).

112. Progress and Teaching of Illumination in Italy. C. CLERICI (*Italy*).

138. Lighting Progress in South America. A. M. BAIDAFF (*Argentine*).

Section 2. ***Photometric Precision***

104. Dutch Photometric Precision Report. C. ZWIKKER and Collaborators (*Holland*).

3. Some Observations on Errors in Photometric Measurements. L. SIMEK (*Czecho-Slovakia*).

4. Sur la précision de la photométrie. E. FERENCZ and J. URBANEK (*Hungary*).

5. Ueber die Genauigkeit der Subjektiven Photometrie von Glühlampen stark verschiedener Lichtfarbe. R. KÖVESLIGETHY and P. SELÉNYI (*Hungary*).

Section 3. ***Daylight***

13. The provision of Adequate Daylight in Building Regulations. P. J. WALDRAM (*Great Britain*).

14. Daylight Illumination and Town-Planning. C. G. MÖLLER (*Hungary*).

46. Die Leitsätze für Tagesbeleuchtung. H. G. FRÜHLING (*Germany*).

93. Visual Performance at Various Levels of Daylight Illumination. K. Y. TANG (*U.S.A.*).

98. Daylight Illumination of Art Galleries with Overhead Lighting. T. HIRAYAMA (*Japan*).

116. On the Influence of the Surface of the Ground on the Illumination from the Sky. A. ANGSTRÖM (*Sweden*).

Afternoon Session, 2.30 *p.m.*

Section 1. ***Home Lighting and Distribution Problems***

36. Home Lighting. C. HASLETT and N. E. MILLER (*Great Britain*).

81. Lighting Activities of Supply Undertakings. C. W. SULLY (*Great Britain*).

125. Adequate Wiring—A Problem of the Illuminating Engineer. G. H. STICKNEY (*U.S.A.*)

137. Voltage and Incandescent Electric Lighting. G. S. MERRILL (*U.S.A.*).

Section 2. ***Photometric Precision***

37. Accuracy of Portable Photometers. A. K. TAYLOR (*Great Britain*).

99. Contribution à l'étude de la précision en photométrie. J. HRDLICKA (*Czecho-Slovakia*).

107. Precision of Photometry. W. F. LITTLE (*U.S.A.*).

16. Accuracy of Commercial Photometry Comparison of Visual and Photo-electric Measurements. B. P. DUDDING and G. T. WINCH (*Great Britain*).

147. Luxmètre de précision à plages homochrome. P. FLEURY (*France*).

152. Sur la précisions des photomètres portatifs. J. WETZEL and A. GOUFFÉ (*France*).

Section 3. ***Daylight***

26. Photo-electric Measurements of Daylight Illumination by the Use of a Model Room. Z. YAMAUTI and K. HISANO (*Japan*).

122. Efficiency of Light-Wells. H. F. MEACOCK and G. E. V. LAMBERT (*Great Britain*).

12. On the Mathematical and Graphical Determination of Direct Daylight Factors. A. C. STEVENSON (*Great Britain*).

92. Prediction of Natural Illumination in Interiors and on Walls of Buildings. H. H. HIGBIE and A. D. MOORE (*U.S.A.*).

MONDAY, 7TH SEPTEMBER. **EDINBURGH.**

Morning Session, 9.30 *a.m.*

Section 1. ***Public Lighting***

74. The Lighting of Seaside Resorts. A. P. ALLEN and J. M. CAMPBELL (*Great Britain*).

33. Calcul de l'éclairement moyen des éspaces circulaires et elliptiques. A. GOUFFÉ (*France*).

90. Mass Experiments in Street Lighting. W. S. STILES (*Great Britain*).

145. Notes on Recent Developments in Gas for Street Lighting in Great Britain as Illustrated by the facts relating thereto in the Cities to be visited by Delegates to the International Illumination Congress, 1931. SIR FRANCIS GOODENOUGH (*Great Britain*).

150. Modern Public Lighting by Electricity. W. J. JEFFERY (*Great Britain*).

Section 2. ***Diffusing Materials***

7. The Properties of Diffusing Glasses, with Special Reference to Surface Effects. J. S. PRESTON (*Great Britain*).

8. The Theory of Diffusion of Light by Opal Glasses. J. W. RYDE and B. S. COOPER (*Great Britain*).

9. Practical Application of the Theory of Opal Glasses. J. W. RYDE and B. S. COOPER (*Great Britain*).

34. Durchsichtigkeit und Durchlässigkeit lichtzerstreuender Gläser. L. BLOCH (*Germany*).

55. Klasseneinteilung für Beleuchtungsgläser. S. SCHÖNBORN (*Germany*).

135. Rapport sur quelques propriétés de certains matériaux diffusants. M. COHU (*France*).

Section 3. ***Aviation Lighting***

42. Zur Frage der Vertikallichtverteilung von Flugstreckenfeuern. F. BORN (*Germany*).

51. Ueber die Anwendung von Leuchtröhren. V. GÖLER and M. PIRANI (*Germany*).

88. The Light Distribution of Navigation Lamps. H. N. GREEN (*Great Britain*).

120. Ground Lighting Equipment for Aviation. BRITISH NATIONAL COMMITTEE.

129. Appareils pour l'éclairage des routes terrestres et le balisage des routes aériennes. M. M. EXELMANS (*France*).

136. Feux de position des avions. M. FRÀNCK (*France*).

154. Transmission of Light through Fog. F. C. BRECKENRIDGE (*U.S.A.*).

Afternoon Session, 2.0 *p.m.*

Section 1. ***Public Lighting***

38. The British Standard Specification for Street Lighting. C. C. PATERSON (*Great Britain*).

65. Street Lighting. E. J. STEWART (*Great Britain*).

66. The Street Lighting Requirements of Different Types of Street. W. S. STILES and J. F. COLQUHOUN (*Great Britain*).

72. Street Lighting by Gas in South London. PUBLIC LIGHTING DEPARTMENT, SOUTH METROPOLITAN GAS CO. (*Great Britain*).

139. American Street Lighting Practice. L. A. S. WOOD (*U.S.A.*).

151. Sur l'établissement d'un projet d'éclairage de voie publique. J. WETZEL (*France*).

Section 2. ***Diffusing Materials***

18. A Simple Method for Testing Diffusing Material. R. KUROSAWA (*Japan*).

19. A Study on the Light Distribution of Diffusing Globes. R. KUROSAWA (*Japan*).

127. Propriétés photométriques des surfaces diffusantes rugueuses. J. DOURGNON and P. WAGUET (*France*).

17. Distribution of Reflected Light from Test Plate of Macbeth Illuminometer and Proper Direction of Measurement. S. SEKI (*Japan*).

130. Les glaces moulées diffusantes comparées aux glaces claires. M. M. EXELMANS (*France*).

Section 3. ***Physiological Problems***

25. Course of Improvement of Visual Acuity during Light Adaptation. H. EGUCHI (*Japan*).

31. Ueber die Sehscharfe unter starker Helligkeit. H. EGUCHI (*Japan*).

48. Beschreibung eines neuen Sehleistungs - Prüfapparate. H. KLEIN (*Germany*).

95. L'origine des sensations visuelles. V. POSPISIL (*Czecho-Slovakia*).

133. Remarques sur la non-réciprocité de certains phénomènes optiques conséquences pratiques relatives à l'art de l'éclairage. J. DOURGNON and P. WAGUET (*France*).

THURSDAY, 10TH SEPTEMBER. **SHEFFIELD**
(SESSIONS AT BUXTON).

Morning Session, 10.0 *a.m.*

Section 1. ***Industrial Lighting***

44. Die Leitsätze fur die Beleuchtung mit künstlichen Licht. H. LUX (*Germany*).

1. Humanitarian Foot-candles. M. LUCKIESH and F. K. MOSS (*U.S.A.*).

52. Webstuhlbeleuchtung. PUTNOCKIE (*Germany*).

73. The Lighting of Factories and Large Buildings. THE SOCIETY OF BRITISH GAS INDUSTRIES (*Great Britain*).

Section 2. ***Architectural Lighting***

49. Schatten und Halbschatten. K. NORDEN (*Germany*).

63. Architectural Lighting. R. WALDO MAITLAND and HOWARD ROBERTSON (*Great Britain*).

94. L'éclairage artistique en France de 1928 à 1931. H. MAISONNEUVE and J. WETZEL (*France*).

Section 3.
Lighting of Railways, Mines & Kinema Studios

40. Eclairage des gares de tirage. COMITÉ DE DIRECTION DES GRANDES RÉSEAUX DE CHEMINS DE FER FRANÇAIS (*France*).
59. Railway Lighting in Great Britain.

59. Railway Lighting in Great Britain. A. CUNNINGTON (*Great Britain*).

53. Bergwerksleuchtung. L. SCHNEIDER (*Germany*).

60. A Standard of Illumination for Mines. W. MAURICE (*Great Britain*).

85. Incandescent Lighting in British Cinema Studios. W. A. VILLIERS (*Great Britain*).

Section 4. ***Light Sources***

29. Construction and A.C. Luminous Intensity of Standard Vacuum Tungsten Filament Lamps. Z. YAMAUTI (*Japan*).

50. Künstlicher Tageslicht und Sonnenlicht. E. LAX and M. PIRANI (*Germany*).

68. Precision in Incandescent Lamp Manufacture. E. CHELIOTI and B. P. DUDDING (*Great Britain*).

118. Sur un photomètre binoculaire à coins et ses applications aux phares et projecteurs. A. BLONDEL (*France*).

Afternoon Session, 2-30 *p.m.*

Section 1.

Section 2. ***Architectural Lighting***

70. Architectural Lighting. L. KALFF (*Holland*).

86. Engineering Aspects of Architectural Lighting. W. J. JONES (*Great Britain*).

126. Note sur la détermination des dimensions des corniches des volets ou des ailettes à masquer la vue directe des sources ou des appareils. J. DOURGNON and P. WAGUET (*France*).

134. Remarques sur les surfaces réfléchissantes mates de brillance uniforme. J. DOURGNON and P. WAGUET (*France*).

Section 3. ***Farm and Horticultural Lighting***

41. Electric Light on the Farm. B. MATTHEWS (*Great Britain*).

58. Künstliches Beleuchtung im Gewächshaus. K. VOGL (*Germany*).

117. Horticultural Illumination. S. ODÈN, G. KÖHLER, and G. NILSSON (*Sweden*).

Section 4.

FRIDAY, 11TH SEPTEMBER. **BIRMINGHAM.**

Morning Session, 10-0 *a.m.*

Section 1. ***Coloured Signal Glasses***

20. Some Fundamental Experiments on Signal Glasses. Z. ISHII and T. TAKESHITA (*Japan*).

21. An Improved Optical System for Japanese Railway Coloured Light Signals. T. ABE (*Japan*).

22. On the Selenium Ruby Glass. K. FUWA (*Japan*).

97. Tests of Coloured Signal Glasses. I. INABA (*Japan*).

Section 2. ***Light - Distribution***

27. Apparatus for Obtaining the Light-Distribution Curve and the Rousseau Diagram. T. ABE and T. TAKEGAMI (*Japan*).

54. Lichtstromverteilung. L. SCHNEIDER (*Germany*).

45. Ueber den Stand der Arbeiten Beleuchtung räumlich zu bewerten. W. ARNDT (*Germany*).

153. Sur une nouvelle méthode de calcul des coefficients d'utilisation. J. WETZEL (*France*).

Section 3. ***Motor Car Headlights***

23. An Experiment on the R.A.C. Disc. REPORT OF COMMITTEE ON MOTOR VEHICLE HEADLIGHTS (*Japan*).

43. Zur Frage der internationalen Regelung der Automobilbeleuchtung. F. BORN (*Germany*).

132. Les lampes electriques françaises employées dans les projecteurs d'automobiles. A. MONNIER (*France*).

84. Vehicle Lighting. LUCAS'S (*Great Britain*).

128. Rôle des irregularités de profil des réflecteurs pour projecteurs d'automobiles. P. WAGUET, A. STAMPA, and J. DOURGNON (*France*).

131. Les derniers perfectionnements apportés sur les projecteurs d'automobiles. M. ROGE (*France*).

Afternoon Session, 2-30 *p.m.*

Section 1.

Luminous Traffic Signals and Lighthouses

39. The Development of Traffic Control by Light Signals in Great Britain. W. M. HAMPTON (*Great Britain*).

111. Lichtsignalregelung. E. SCHUPPAN (*Germany*).

71. Lighthouses. J. P. BOWEN (*Great Britain*).

119. Brilliance Apparente des Surfaces de sortie des appareils optiques éclairés par des sources le lumière. A. BLONDEL (*France*).

Section 2. ***Heterochromatic Photometry***

30. Notes sur la mesure de lumière à couleurs différentes. Z. YAMAUTI (*Japan*).

102. Photometric and Spectrophotometric Comparison of White and Coloured Light Sources. B. P. DUDDING and G. T. WINCH (*Great Britain*).

142. La colorimétrie des sources lumineuses ponctuelles. J. ESCHER-DESRIVIÈRES (*France*).

The International Commission on Illumination

Eighth Session, Cambridge, Sept. 13th-19th, 1931

The headquarters of the International Commission on Illumination, the eighth session which will follow immediately after the International Illumination Congress, will be located at Trinity College, Cambridge.

On the opening day (Sunday, September 13th) the Executive Committee will assemble. On subsequent days the following subjects will be discussed:

SEPTEMBER 14TH :—

At 9-30 a.m. General Meeting and Opening of Proceedings.

At 2 p.m. (i) Street Lighting, (ii) Daylight Illumination and (iii) Nomenclature.

SEPTEMBER 15TH :—

At 9-30 a.m. (i) Lighting Applications, (ii) Coloured Signal Glasses, (iii) Definitions and Symbols, and (iv) Photometric Test Plates.

At 2 p.m. (i) Traffic Signals, (ii) Glare, and (iii) Kinema Lighting.

SEPTEMBER 16TH :—

At 9-30 a.m. (i) Automobile Headlights, (ii) Accuracy of Photometric Processes, (iii) Distribution of Flux of Light.

SEPTEMBER 17TH :—

At 9-30 a.m. (i) Lighting Involved in Aerial Navigation, (ii) Heterochromatic Photometry, and (iii) Lighting Education.

At 2 p.m. General Session.

SEPTEMBER 18TH :—

At 9-30 a.m. (1) Street Lighting, (ii) Colorimetry, and (iii) The Lighting of Factories and Schools.

At 2 p.m. (i) Diffusing Materials, and (ii) Daylight illumination.

SEPTEMBER 19TH :—

At 9-30 a.m. Plenary Session and Termination of Proceedings.

(N.B.—A Conference on the Standardization of bases and sockets of incandescent electric lamps, organized by the International Electrotechnical Commission, will be held at Cambridge during the afternoon of September 15th. Members of the International Commission on Illumination are invited to participate in this Conference.)

The Daylight Illumination Required in Offices

Technical Paper No. 12, issued by the Department of Scientific and Industrial Research, presents a report on the above subject prepared by Mr. A. K. Taylor, and is furnished with a brief explanatory preface by Mr. Clifford C. Paterson, the Chairman of the Illumination Research Committee.

Briefly, the report sets out to establish the minimum desirable value for the daylight factor in offices—a point that is by no means easy to settle! The Report affirms, what is now conceded by experts, that the only satisfactory basis of judgment of daylight illumination is in terms of the "daylight factor," which it is suggested, should not be less than 0.2 per cent. in order that the illumination may be considered adequate.

We hope to comment more fully on this report in our next issue.

The Development of Street Lighting in Tokyo

By TŌRU KASHIKI

(*Researcher, Tokyo Institute for Municipal Research; Member, Institute of Electrical Engineers of Japan.*)

The following contribution has been specially written for the Members of the Illuminating Engineering Society, and has been sent to us from the Far East.

Introduction.

IN ancient times, it is related, anyone who walked by night carried for himself a pine-torch, a bundle made of thin resinous slips of pine. Next, much later, there came the paper lanterns equipped with candles made of vegetable wax. These were both portable types of lights.

As towns developed it became usual for tradesmen to hang out their lanterns, mostly rectangular in shape, with lights at their corners to serve as an advertisement. At the same time people used to light the familiar spherical lanterns at their doors at times of religious festivals. But the first public street light of fixed type was the *tsuji-andon,* as shown in the figure (Fig. 1). This was constructed of wood, and burned chiefly colza oil as fuel, and was in use down to the middle of the nineteenth century.

From about 1860 onward, with the development of the foreign trade, a revolution in street-lighting equipment began. Kerosene lamps were imported in about 1866, and by 1870 had spread rapidly; by the end of the nineteenth century they were used for lighting the streets of all important towns. Nevertheless, really effective street lighting did not begin until the introduction of the gas lamps.

Introduction of Gas Lamps.

In 1871, Mr. Kimimasa Yuri, the Governor of Tokyo Prefecture at that time, initiated a project for public lighting by gas, and gave instructions to Mr. Kaemon Takashima for the purchasing of the apparatus and equipment from London. Next year the apparatus and equipment arrived, but owing to a change of Governor the project was abandoned. Yet Mr. Takashima established, at that time, a gas company in the City of Yokohama. He installed a street-lighting system, and on September 29th, 1872, lighted the streets with gas in the foreign concessions area, to the general admiration. Thereafter he applied to the Prefectural Office of Tokyo for a franchise to provide gas lighting, by utilizing the equipment previously purchased. On the other hand, the Tokyo Kaigisho, which eventually became the Chamber of Commerce and Industry of Tokyo, passed a resolution for the installation of street lamps in the important quarter of the city, and hired a French engineer to supervise the construction work in 1873. A gasworks designed by Mr. Takashima was constructed at Shiba-ward, and the installation of gas lamps in Kyobashi Street, one of the most important streets in Tokyo, was commenced in January, 1874. These lamps were lighted on trial for three nights from December 15th of that year. The lamps thus lighted were eighty-five in number. This was the first public lighting by gas in Tokyo, and in this way the first gas undertaking began in that city.

Kerosene Lamps Entered.

Next Mr. Kinbei Matsumoto and Mr. Katsuro Nishimura each designed a special type of kerosene lamp, and simultaneously appealed to the Tokyo Kaigisho to adopt their own types of lamps. The Kaigisho accordingly determined to install both types. Forty-eight lamps of Matsumoto's type were set up on the Bakurocho Street in August, 1874, and were lighted on September 1st. The next year five hundred lamps of Nishimura's type were installed.

In May, 1876, the enterprises were transferred from the Kaigisho to the Prefecture, which effected control by means of a new department. At the same time the public lighting system with the kerosene lamps was abandoned. But, in later days, the kerosene-lamps systems were again installed by private companies, 12,512 lamps being thus lighted at the end of 1909. The "private door" oil lamps also numbered as many as 92,617 at that time.

Street Lighting by Gas.

FIG. 1.
The Tsuji-Andon.

The gas lamps, however, increased steadily from month to month, and by the end of 1875 there were about 350. The bright light of these lamps was a great surprise in those days. An author of that period described it as follows: "The sun sets in the west, and the veil of night is dropped, when a lamp-lighter appears in the street and lights the gas lamps—then there appears a nightless world, as though to make us believe that the sun is not set. Even a little girl may walk alone without fear at night, for the most terrible goblin could not frighten her."

On the other hand, there was much controversy about the expensiveness of these projects. At first, half of the cost of the lighting was assessed upon the property owners along the streets thus lighted, but complaints of the property owners and diminished revenue from this source compelled the Prefecture to defray the cost from the taxes. After the gas undertaking was sold out, in 1885, to a private company, progress in the street lighting out of public funds was checked considerably, although 5,667 lamps could be counted at the end of 1914. Since the resolution of the Tokyo City Council in 1918 to change over to electric lighting, the number of gas lights has decreased rapidly. At the same time, it should be understood that the transfer of the extension policy of the Gas Company from the field of lighting to that of heating has accelerated this tendency.

Electric Lighting.

It was in July, 1882, that the first electric lamp was installed on the street at the front of the Okura-gumi Company at Ginza. This step was taken by the arc-lighting enterprise promoted by Mr. Magoichiro Yokoyama, Kihachiro Okura, and others. This electric arc lamp of 2,000 candle-power, lighted from a Bush dynamo, was imported from the United States of America. Although this was only a trial, the people were as much impressed by them as by the first installation of gas lights.

The first street fittings using the incandescent electric lamps were those installed in the Nihonbashi-ward on December 10th, 1887, and were supplied with energy by a power station of the Tokyo Electric Company. There were only ten of these lamps, and at that period they were naturally not a success.

Private-owned Street Lighting.

Though there are no accurate records of earlier street lighting by electricity, there is reason to believe the number of incandescent lamps in use was small. But as a consequence of the rapid advances in manufacture, subsequent progress was rapid. The pioneer of the modern electric street-lighting system was that installed in Ginza Street in 1919, though the first one using modern incandescent lamps in our country was probably that set up on a certain street in the City of Kyoto in 1915. By August, 1923, the number of private-owned street-lighting installations had increased to about thirty. Then a terrible disaster happened. On September 1st, 1923, a tremendous earthquake attacked the whole Tokyo district, and a large part of the city was destroyed by the ensuing fire. People had to pass several nights in danger and darkness. They were, therefore, much encouraged when the electric lamps were relighted after a few days, after the damaged distributing mains had been repaired.

The great work of reconstruction was at once begun and continued with great keenness. The invaluable effect of the lighting in facilitating the preservation of order by night was strikingly demonstrated, and as the favourable effects upon business were perceived by the shopkeepers a canvass with the object of increasing the lamps was started by the Electricity Company in February, 1926. The private lamps on the streets have since increased with great rapidity. But most of these installations were only equipped with one to three low-intensity lamps (mostly 32 candle-power or less), with opalescent glass globes of spherical shape mounted on the slender square wooden poles, and the lamp-spacing was only two or three times of its height. It was estimated by the survey of the Street Lighting Committee of the city, in June, 1927, that the number of private-owned lamps was about 55,000 (but according to the estimation of the Electricity Company there were more than 100,000!), and the total intensity about 3,100,000 candle-power, i.e., corresponding to an average intensity of 56 candle-power per lamp. Such lamps cost about 13.6 yens per lamp to maintain for a year. (One "yen" is nearly equal to two shillings.) The length of the street thus illuminated is about 169 kilometres, or less than 17 per cent. of the total streets in the city.

Street Lighting by Public Outlay.

According to the report of the city authority, ending on March 31st, 1929, the current expenditure for the public lighting on the roads and bridges was about 96,361 yens, including 73,441 yens for expenditure on electric street lighting and 22,664 yens for the maintenance (see Fig. 2), which is equal to 1.63 per cent. of the current expenditure for roads and bridges. The items of expenditure on the electric street lighting were as follows:—

	Yen
1,500 lights on roads	28,328
1,029 lights on tramway posts	7,474
2,275 lights on bridges	35,205
Lamp renewals	2,432

The expenditure for the park lighting is not included, as this is separated from the roads and bridges; this involves an expenditure of about 3,086 yens for 94 gas lights (45 candle-power per light), and 15,538 yens for 1,249 electric lamps.

Although the number of publicly-owned street-lighting units is still comparatively small, these are in general of superior design. There are also in the city a few public lamps set by the various Governmental offices.

Lamps on Tramway Posts.

The city is required to install a lamp on every tramway post, and to light the centre one all night and the side one during the operating hours of the cars after sunset and before dawn. They have over 10,000 lamps (mostly 40-watt) on such posts. Though these are regarded mainly as "beacon lights," they serve a useful purpose for street lighting. The item of 7,474 yens for 1,029 lights on tramway posts, included in the expenses of the street lighting mentioned above, comprises the cost of substituting lamps of higher candle-power on these posts.

Lighting Practice.

The fittings introduced by the city authorities are mostly cast-iron standards equipped with ornamental units with rippled-glass globes; in general one 100-watt lamp per post is used, a "staggered" arrangement being adopted on some principal thoroughfares. The lighting of the business streets is almost entirely left to the caprices of the shopkeepers. Now, some of the typical installations by the city government are stated in Table I.

Reconstruction Works and Improved Lighting.

Notwithstanding this unique demonstration of the value of street lighting for the public welfare, and especially as an aid in preventing street accidents, public lighting was almost neglected in the reconstruction programme of Tokyo. The Reconstruction Bureau made new installations in three places only, but one of the trunk lines (No. 8) must be admitted to be the highest class in our country.

These lighting units are installed on the newly-constructed route of 73 metres width, with a 22-metre roadway for high-speed vehicles in the centre, 5.5-metre tree zone, 12-metre roadways for low-speed vehicles, and 8-metre footpaths on both sides. Ornamental standards, with two pear-shaped units equipped with 1,000-watt or 500-watt lamps were spaced at intervals of 42 or 18 metres, and at a height of 6 metres above the ground in the three zones. There are also ornamental standards, each equipped with one 400-watt lamp, at the roadway sides of the footpaths. The former cost about 1,400 yens per post, and the latter 326 yens. In addition, the underground distribution system cost 6,048 yens. The intensity of horizontal illumination along the centre line of the roadway varies from about 0.45 to 4.5 metre-candles.

TABLE I

Situation	Width of Street (metres)	Length of Street (metres)	Watts per Post	Average Lamp Spacing (metres)	Height of Light Source (metres)	No. of Posts	Arrangement of Lamps on Street	Horizontal Illumination on Street Surface (metre-candles) min.	max.	Cost per Post (Yens)
(1) Thoroughfare toward Tokyo Station ..	73	180	2 × 750	35·5	9·1	9	opposite	0·45	11	—
(2) From Hibiya Park to Otemachi ..	—	1,200	100	36·5	4·5	29	one side	—	—	581
(3) The Back Approach to the Meiji Shrine	22	1,200	100	33·5	4·4	60	staggered	0·3	4·5	—

Notes :—(1) Bracket type, pendant lighting unit.
(2) Ornamental unit with rippled glass globe on the top of the post.
(3) Type as shown in Fig. 4 with opalescent glass globe.
(Recently, the inverted J-type standards have been adopted on some of the secondary thoroughfares by the authority.)

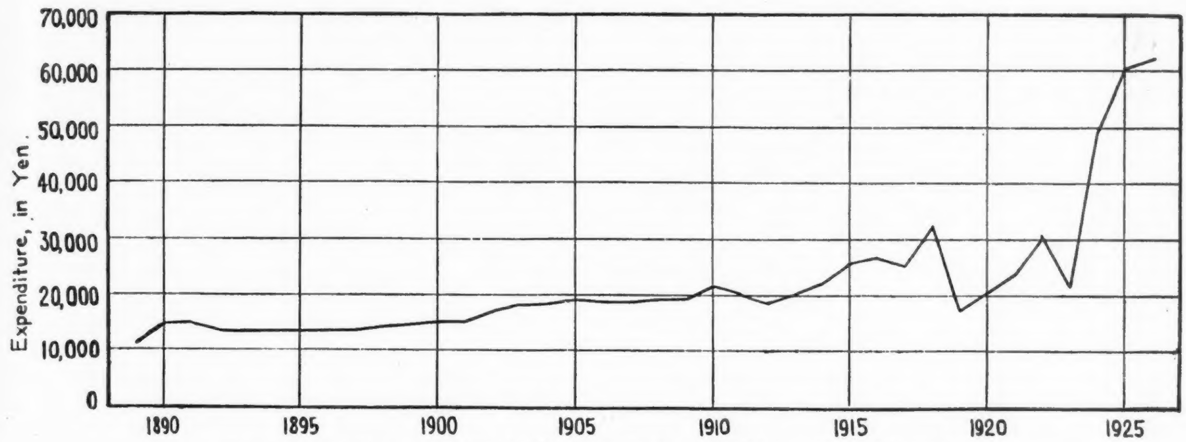


FIG. 2.—Expenditure on Public Lightings of Roads and Bridges. (General Account.)

Supply of Energy.

To supply the energy to the public or private lamps on the streets in Tokyo, ordinary distribution lines, usual for domestic lighting, are utilized. Except for a few cases in which tramway pole lights are used, the distribution of energy is performed by the alternating-current multiple system. (In Japan the series system is not adopted except in a part of Nagoya City.) Knife-switches fitted on the lamp-posts are mainly used to light and extinguish lamps. Time-switches are not fitted on the posts, nor is any method of remote control yet adopted. Lights in districts not supplied in the daytime are controlled by the sub-station men. At the present moment the energy for lights is supplied by the City Electric Department and the Tokyo Electric Company.

FIG. 3. Specially-designed Standard for the Approach to the Meiji Shrine.

Rates.

It is the custom in our city for the charges of electricity for street lights to be assessed at an amount per month per lamp of given consumption in the same manner as those for ordinary domestic lighting, but in the case of city-owned lights a discount of 20 per cent. is allowed.

Laws and Regulations.

In the legislation relating to highways there are no articles positively requiring the installation of street lights. Street lighting is regulated mainly by an order of 1920 of the Home Office, which enabled local authorities to grant permission for the use of private street-lighting systems in the streets. In the city of Tokyo the use of private street-lighting systems is controlled by a city ordinance of 1921 and by the regulations of 1926 of the Metropolitan Police Board. Both of them are simple in character.

Efforts for Improvement.

Several years ago the Illuminating Engineering Society of Japan appointed a special committee to investigate street-lighting problems. Their report was published in pamphlet form in 1924. In 1925 a new committee was formed and has made investigations with the object of framing proper standards of lighting in Japan. The results were published as a rough draft in 1930. The city authorities also appointed a committee in June, 1926, for the purpose of determining proper standards for municipal installations and making suggestions on finance.

As stated previously, there were in evidence on the street many inferior types of lighting fittings installed by merchants, which were regarded as nuisances which did not do the city credit. Many of them were both unsightly and uneconomical. Moreover, rapidly increasing high-speed traffic made the installation of more effective lighting systems necessary. *The Tokyo Institute for Municipal Research*, therefore, took up the problem in 1926 and made a thorough-going study into the practices of the various cities in the world, as well as theoretical principles. The results were reported in 1927, and issued in a revised and enlarged form in 1929. The Institute, in December, 1927, made a proposition to the Minister for Home Affairs, the Commissioner of the Metropolitan Police, and the Mayor of Tokyo, with the request that copies be sent to all mayors in Japan. The chief propositions were as follows:—

(1) The Road Law should be amended so to make the installation of street-lighting an essential accessory to the road, and provisions must be made for improvement and regulation of such street lighting.

(2) Regulations should be made in regard to the intensity, spacing, mounting height, and arrangement of the light-sources, the prevention of glare, the minimum intensity of illumination, and the system of lighting best adapted to each district.

(3) The use of the high-class installation for public lighting should be encouraged.

(4) Low-grade private lights, etc., should be prohibited.

In 1927 the Electrical Association of Japan made a proposition to the Government that the provision of adequate street lighting should be incorporated in all city planning schemes. Various other societies and communities supported the Electrical Association.

Standard for Lighting.

There have been three series of recommendations for street lighting in our country. The first of them was made in 1927 by a committee appointed by the Mayor of Tokyo. They are as follows:—

(i) *Intensity of illumination* (in metre-candles)—

Class of street	1st	2nd	3rd	4th	5th	6th
Business	6	4	3	2	1	0·5
Office-building district	4	3	2	1	0·5	—
Residential	2	1	0·5	0·2	—	—
Manufacturing district	2	1	0·5	0·2	—	—
Intersections	10	6	4	3	—	—
Squares	More than 2 m.c.					
Bridges	Nearly equal to that on the same road.					
Tunnels: under the elevated railways	3 to 1 m.c.					
Parks, parkways, boulevards, etc.	3 to 0·2 m.c.					

(ii) The *mounting height* of the light-source should be 3.5 to 7 metres, and the lamp spacing 40 to 60 metres, according to the width of the street. Staggered arrangements of light should be adopted.

The second series of standards was framed in 1928 by the Committee on Electric Equipment in Architecture (a joint committee appointed by the Illuminating Engineering Society and the Institute of Japanese Architects). In these an intensity of illumination of 2 to 10 metre-candles for business streets, 1 to 3 m.c. for thoroughfares, and 0.2 to 1 m.c. for residential and general narrower streets is recommended.

The third recommendation is presented in the proposed standard specification on street lighting of the Illuminating Engineering Society of Japan in 1930. (See the *Journal* of that Society, Vol. 14, No. 3.) This specification is not necessarily a complete one in my opinion. (See the *Journal*, Vol. 14, No. 5.)

The conditions in Tokyo are not necessarily typical of our country, but we find elsewhere many installations which deserve to be studied and improved.

Recently the reconstruction work has approached its end. In the greater part of the district affected permanent installations of lighting are now introduced by merchants, many of which are intolerable. The rational control of street lighting in Tokyo is becoming more and more urgent, for it will be very difficult to correct such conditions if once allowed to be completed. As a basis of this control, the writer drafted a model scheme regulation of street lighting last year. (See the *Journal of the Electrotechnical Society of Waseda, Japan*, Vol. 11, No. 12.)

The degree of progress attained in the illuminating and electrical engineering of to-day is remarkable, and the realization of better street lighting is easy. There is, however, only one way in which to improve this unrivalled instrument for promoting public welfare and safety by night, better facilities for traffic control, and artistic appearance of thoroughfares. Success depends upon the co-operation of municipal authorities with citizens and lighting experts in the common task of rendering cities safer and more beautiful by night.

Public Lighting in Sheffield

The first annual report of the Lighting Department in Sheffield for the year terminating March 31st, 1931, which has recently been issued, is an interesting document. The results recorded, as well as the arrangement of the report itself, reflect credit on the skill and ingenuity of the Lighting Engineer, Mr. J. F. Colquhoun. One leading feature of the lighting in Sheffield is the steady extension of the automatic control of public lamps, with the result that the number of lamps attended to by a given staff has been practically doubled. The "lamp-lighter," in fact, is being replaced by a "lamp attendant," whose work calls for training and skill.

During the year 507 new gas lamps and 680 new electric lamps have been installed. At the present time the number of electric lamps in use is 3,867 and the number of gas lamps 15,708. In many places the size of the electric lamps or gas burners has been increased and lamps have been subjected to systematic overhaul. In the course of the year the systematic overhaul of 3,181 street lamps was effected and 2,990 old burners were cleaned, reset, painted and tested in the workshops and test room. (It is instructive to notice that during the past year no less than 11,064 broken lantern panes out of a total of 62,832 required to be replaced! Street accidents, heat cracks, winter's gales are partly responsible, but one gathers that the stone-throwing destruction of certain inhabitants of Sheffield also constitute a material source of damage.)

One important development has been the general increase of the height of the lamps from 11 ft. 6 ins. to 13 ft. 6 ins., a step which carries into effect the requirements of the British Engineering Standards Association Specification for Street Lighting, and has received practical approval by motorists. Reference is made to the useful work of the Sheffield Illumination Society, notice of whose activities frequently appears in this journal.

Finally, we would like to single out for special mention the very enterprising series of graphs and coloured diagrams included at the end of the report, which gives a great deal of information in a very clear and pictorial form. Graphs A and B illustrating the distribution of expenditure on lighting are most informative. These are followed by other striking diagrams showing how the cost per candle per annum and the cost of lighting service per head of population have varied. It is stated that the cost of candle-power has remained at 6½d. per year, though there has been a material increase in the number of burning hours. Especially striking are the figures for candle-power per head of population, which has increased from 0.95 in 1923-24 to 4.38 in 1930-31.

Public Lighting in Liverpool

A feature of the report of the City Lighting Engineer of Liverpool (Mr. P. J. Robinson) for the past year is the tabulation for the first time of *passages*, in addition to roadways lighted. One discovers with some surprise that there are over 200 miles of passages, as compared with 640 miles of streets. Of the roadways 201 miles are lighted by electricity, the remainder with gas—except for half a mile that is still lighted with oil lamps! Practically the whole of the passages are lighted with gas and there are 10 miles of "courts" all electrically lighted. The total mileage is given as $865\frac{3}{8}$, lighted by 11,607 electric and 17,481 gas lamps, figures which differ only slightly from those of the previous year. Amongst recent developments we note the attention paid to the lighting of island refuges, for which special units have been adopted, and the design of special lanterns with a view to diminution of glare. We observe that in the case of the recently adopted centrally suspended lighting, 35 ft. has been adopted in preference to 40 ft. for the mounting height as maintenance is thus rendered easier. It was formerly the practice to extinguish certain lamps at midnight entirely, but the resultant lack of uniformity in illumination was regarded as a drawback. Certain lanterns have now been redesigned and furnished with duplicate lamps, only one of which is extinguished, so that the consumption can be reduced without giving rise to uneven lighting effects. The number of gas mantles used during the year has diminished from 3.17 to 2.99 per burner per annum, and the number of electric lamps per point from 2.75 to 2.52, apparently evidence of greater robustness or more skilful maintenance. The net annual expenditure for public lighting (£116,434) corresponds to a rate of 5d. in the £, which is surely a very reasonable figure.

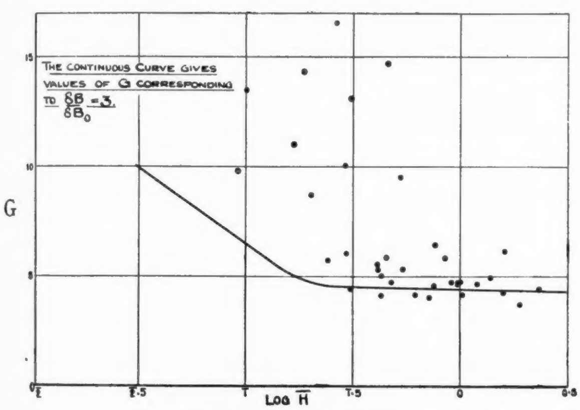
The Evaluation of Glare in Street-lighting Installations

By W. S. STILES, Ph.D.

(Concluded from "The Illuminating Engineer," July, 1931, p. 166.)

6.—Maximum Permissible Glare.

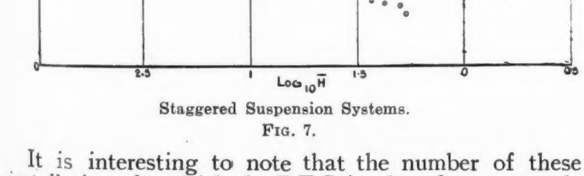
Having arrived at a method for computing a glare figure for a street-lighting installation, the next question is to decide how large a value for the glare figure should be permitted in practice. The logical course appears to be to fix a value of $\frac{\delta B}{\delta B_0}$ (see Section 2). We may, for example, allow the threshold in the presence of glare (δB) to be as much as, but not more than, three times the threshold with the sources screened from view (δB_0). Since it was elected to define the glare figure as $G = \frac{\beta}{B}$ rather than as $\frac{\delta B}{\delta B_0}$, the critical values of G corresponding to $\frac{\delta B}{\delta B_0} = 3$ at different brightness levels, will be different. Taking into account the Fechner fractions for the different brightness levels, the values of G corresponding to $\frac{\delta B}{\delta B_0} = 3$ are plotted in



Centre Suspension Systems.

Fig. 6.

Fig. 6. On the same diagram the glare figures G of the centre suspension installations computed in Table 3 are shown. Fig. 7 gives a similar diagram for the staggered systems.



Staggered Suspension Systems.

Fig. 7.

It is interesting to note that the number of these installations for which the B.E.S.A. glare figure exceeds the B.E.S.A. limit (10) equals 13 out of a total 36. Reference to Figs. 6 and 7 shows that on the new method, taking the maximum permissible value of $\frac{\delta B}{\delta B_0}$ to be 3, 29 of the central suspension installations are excluded out of 36, and 15 of the staggered suspension systems out of 36 are excluded. The choice of $\frac{\delta B}{\delta B_0} = 3$ as the maximum permissible value represents therefore a tightening-up of the glare restriction as compared with the present B.E.S.A. Specification. *The value* $\frac{\delta B}{\delta B_0} = 3$ *has been suggested only as an illustration, and no particular significance must be attached to this figure.* The choice of a suitable limiting value for $\frac{\delta B}{\delta B_0}$ must depend on what loss of eye sensitivity can *safely* be allowed, and this is a difficult problem. Account must, of course, also be taken of the possibilities and limitations of practical street-lighting equipment.

7.—Elimination of Glare from Distant Lamps.

It has already been pointed out that the street lights beyond the nearest lamp contribute a considerable amount to the total glare effect in an installation. It is possible, however, to eliminate the glare effects of distant lamps without materially affecting the functions of an installation in disclosing objects on the roadway. It is proposed that the polar curve of the fittings shall drop to zero or an agreed small value, at the direction passing through a point 5 ft. above the base of the next post. The accompanying diagram (Fig. 8) will make

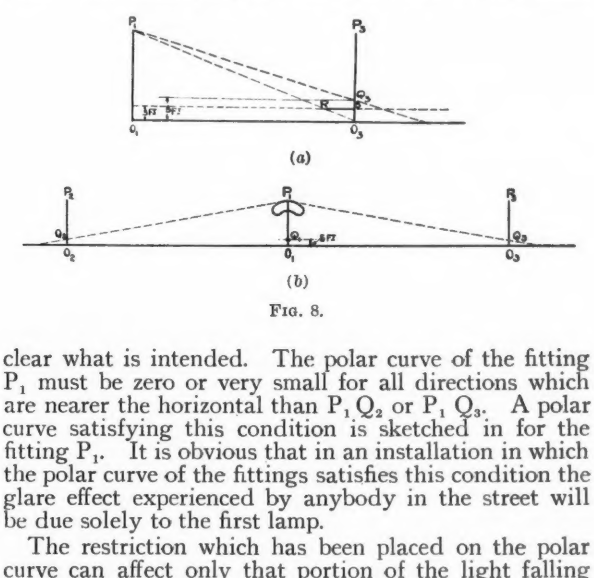


Fig. 8.

clear what is intended. The polar curve of the fitting P_1 must be zero or very small for all directions which are nearer the horizontal than $P_1 Q_2$ or $P_1 Q_3$. A polar curve satisfying this condition is sketched in for the fitting P_1. It is obvious that in an installation in which the polar curve of the fittings satisfies this condition the glare effect experienced by anybody in the street will be due solely to the first lamp.

The restriction which has been placed on the polar curve can affect only that portion of the light falling on a given span which comes from lamps other than those defining that span. It is well known that for all practical purposes this portion of the light can be, and in fact commonly is, neglected when considering the horizontal illumination of the roadway. Thus eliminating it altogether can make only an insignificant difference to the horizontal illumination. As regards the vertical illumination, it may be noted that if the condition had been that the polar curve should cut off sharply at the direction pointing to the base of the next post, then a vertical surface, say 3 ft. from the ground, would pass through a region near the post in which its vertical illumination would be zero. Thus if the cut-off direction is $P_1 O_3$ (Fig. 8), then in the Stretch RS the vertical illumination is zero. The choice of the cut-off direction pointing to a point 5 ft above the base of the post eliminates this stretch of zero vertical illumination, and allows the light from the next lamp to come into play before cut-off occurs. It is clear from this discussion that our condition will not seriously affect vertical illumination at heights above the roadway which are important in street lighting.

The design of street-lighting fittings to satisfy the above cut-off requirement is, of course, a matter for manufacturers. Actually there are fittings in use,

particularly on the Continent, which do give a cut-off, and there seems no fundamental difficulty in the way.

In conclusion, it is well to repeat that in the above the disability effect of glare has alone been considered. Discomfort and attractiveness (at night), which, if not more important, are certainly more immediately obvious factors in street lighting, have not been dealt with.

The writer has much pleasure in expressing his thanks to Mr. C. Dunbar, M.Sc., for his assistance in computing the tables and for helpful discussion.

APPENDIX I.

The method of computing the maximum glare effect due to the first lamp in a staggered suspension system is as follows: —

Let CB (Fig. 9) be the direction of the centre of the roadway and A the lamp whose glare effect at C is to

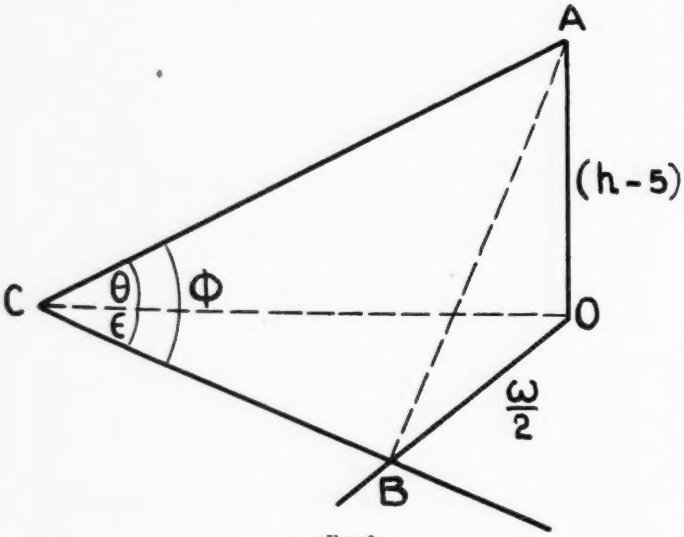


FIG. 9.

be estimated. The direction of vision is along CB. Then if E is the illumination produced by the lamp on a vertical plane at C whose normal is CB, the glare contribution to β of this lamp is given by

$$\frac{4\cdot16\,E}{\phi^{1\cdot5}} = 4\cdot16\,\frac{I_\theta}{(h-5)^2}\cdot\frac{\sin^2\theta\cos\phi}{\phi^{1\cdot5}}$$

Now $\cos\phi = \cos\theta\cos\varepsilon$

and $\cos\varepsilon = \left[1-\left\{\frac{w}{2(h-5)}\right\}^2\tan^2.\,\theta\right]^{1/2}$

$$\therefore\ \frac{4\cdot16\,E}{\phi^{1\cdot5}} = 4\cdot16\,\frac{I_\theta}{(h-5)^2}\cdot\frac{\sin^2\theta\cos\theta}{\phi^{1\cdot5}}\cdot\left[1-\left\{\frac{w}{2(h-5)}\right\}^2\tan^2\theta\right]^{1/2}$$

$$= 4\cdot16\,\frac{I_\theta}{(h-5)^2}\cdot\frac{\sin^2\theta\cos\theta}{\theta^{1\cdot5}}\cdot\frac{\theta^{3/2}\left[1-X^2\tan^2\theta\right]^{3/2}}{\left[\cos^{-1}\left\{\cos\theta\,(1-X^2\tan^2\theta)^{1/2}\right\}\right]^{3/2}}$$

$$= 4\cdot16\,\frac{I_\theta}{(h-5)^2}\,\frac{\sin^2\theta\cos\theta}{\theta^{1\cdot5}}\,.\,\lambda \quad \ldots\ldots\ldots \quad (1)$$

$$\text{where } \lambda = \frac{\theta^{3/2}\left[1-X^2\tan^2\theta\right]^{1/2}}{\left[\cos^{-1}\left\{\cos\theta\,(1-X^2\tan^2\theta)^{1/2}\right\}\right]^{3/2}}$$

$$\text{and } X = \frac{w}{2(h-5)}$$

The maximum glare effect due to the first lamp in a staggered suspension system is therefore given by that value of θ which makes $\frac{I_\theta}{(h-5)^2}\,\frac{\sin^2\theta\cos\theta}{\theta^{1\cdot5}}\,.\,\lambda$ a maximum. λ is, of course, a function of θ, and in Table IV are given values of λ for different values of θ and X.

It is stated above that the maximum glare effect due to the first lamp in a centre suspension system is given by

$$\frac{4\cdot16}{(h-5)^2}\cdot\frac{I_\theta\sin^2\theta\cos\theta}{\theta^{1\cdot5}} \quad \ldots\ldots\ldots \quad \text{(ii)}$$

where θ has the value θ_m, for which $\frac{I_\theta\sin^2\theta\cos\theta}{\theta^{1\cdot5}}$ is a maximum. This result can be obtained from equation (1) by putting $X = o$, in which case B and O coincide.

Now for any likely value of X, λ varies only slowly in the range $\theta = 0^\circ$ to $\theta = 30^\circ$. It follows that the value of θ in this range, which makes (ii) a maximum, can also be considered to make (1) maximum. If it has been previously determined that a fitting in centre suspension gives a glare effect due to the first lamp of value T_1 at an angle of θ_m with the horizontal, then the maximum glare effect due to the first lamp in staggered suspension will be λT_1 (where λ can be read off from the curves), provided that θ_m lies within the range $0^\circ - 30^\circ$. In other words, the value θ_m, which makes the glare effect due to the first lamp a maximum, is very nearly the same for both centred and staggered suspension systems, provided that $\theta_m < 30^\circ$.

If $\theta_m > 30^\circ$, then the maximum glare effect due to the first lamp in staggered suspension must be computed separately by considering the value of θ which makes the triple product $I_\theta\,.\,\frac{\sin^2\theta\cos\theta}{\theta^{1\cdot5}}\,.\,\lambda$ a maximum.

APPENDIX II.

Consider a straight level street in which the carriage-way has a width w feet and the street lamps are mounted at a height h feet. The spacing of the lamps is s feet. The two principal methods of distributing the lamps are the centred and staggered suspension systems. (N.B.—In the case of symmetrical and axial asymmetric fittings, one-side lighting systems give the same average illumination as staggered systems.)

We shall consider the average illumination on the carriage-way. It is clear that this average illumination H is given by the *total* flux of light F cast on the whole carriage-way by *one* lighting unit, divided by the area between any two fittings, i.e., sw.

$$\text{Thus } H = \frac{F}{sw}$$

SYMMETRIC FITTINGS.

Case I.—Let the width w of the carriage-way be so small that the illumination across it is sensibly constant. The difference between centred and staggered suspension systems disappears in this case.

Suppose the candle-power of the fitting in a direction making an angle ϕ with the vertical to be $I\phi$. The total flux of light F cast on the carriage-way by one fitting is given by

$$F = 2\int_{x=o}^{x=\infty}\frac{I\phi\cos^3\phi}{h^2}\,w\,dx$$

$$dx = h\sec^2\phi$$

$$\therefore\quad F = \frac{2w}{h}\int_{\phi=o}^{\phi=\pi/2} I\phi\cos\phi\,d\phi$$

Now if the integral had been $\int_o^{\pi/2} I\phi\sin\phi\,d\phi$, it would have equalled the familiar photometric quantity, the mean hemispherical candle-power for the fitting for its lower hemisphere. The actual integral is the mean hemispherical candle-power of a fitting of polar curve $I^1\phi$, such that $I^1\phi = I\,(\pi/2 - \phi)$. This is just as easy to determine in practice as the mean hemispherical candle-power of the original fitting. We can write

$$\int_o^{\pi/2} I\phi\cos\phi\,d\phi = I\ \text{com}$$

where (I com) is the mean hemispherical candle-power of the "complementary" fitting whose polar curve is related to that of the actual fitting by the equation

$$I^1\phi = I\ (\pi/2 - \phi)$$

$$\therefore H = F/sw = \frac{2w}{h}\ I \text{ com } \frac{1}{ws}$$

$$= \frac{2\ I \text{ com}}{sh}$$

Case II.—Considering a carriage-way of any width, let the candle-power I of the fitting be the same for all directions in the lower hemisphere. In this case it is easy to compute by direct integration the flux F reaching the street from one fitting.

(*a*) *Staggered system.*

$$F = 2I \tan^{-1} w/h$$

$$H = \frac{2I}{sw} \tan^{-1} w/h$$

(*b*) *Centred system.*

$$F = 4I \tan^{-1} w/2h$$

$$H = \frac{4I}{sw} \tan^{-1} w/2h$$

Case III.—A generalization must be made to meet the case in which no restriction is placed on the width of carriage-way or the distribution of candle-power of the fitting. The results obtained for Cases I and II are exact. Considering a staggered suspension system, the simplest combination of the formulæ derived above is

$$H = \frac{2I \text{ com}}{sw} \tan^{-1} w/h \quad . \ . \ . \ . \ . \ . \ . \ . \ . \ . \quad (1)$$

This will be a better approximation for the general case than either Case I or Case II. A slightly better approximation can be arrived at without unduly complicating the expression. The road width correction factor $\tan^{-1} w/h$ arises principally from the illumination near to the post, i.e., to values of $I\phi$ near to $\phi = o$. At greater distances from the post, i.e., for greater values of ϕ, conditions are much the same as in Case I, where the illumination is assumed constant across the road width. If the candle-power for small values of ϕ is small compared with the average candle-power, the road width will not affect H as much as (1) assumes. As a modified formula to meet this objection, the following is advanced:—

$$H = \frac{2\ I \text{ com}}{sh} \left[1 - \frac{I\ v}{I \text{ com}} \left(1 - \frac{h}{w} \tan^{-1} \frac{w}{h}\right)\right]$$

where Iv is the candle-power of the fitting at $\phi = O$, or if the supporting spigot interferes seriously with the intensity in this direction, the average value of $I\phi$ over a small range of value of ϕ (say from 0° to 10°) can be used.

The corresponding formula for a centre system will be

$$H = \frac{2\ I \text{ com}}{sh} \left[1 - \frac{I\ v}{I \text{ com}} \left(1 - \frac{2h}{w} \tan^{-1} \frac{w}{2h}\right)\right]$$

The estimation of the average horizontal illumination in the span due to an asymmetric fitting is more difficult. A reasonable approximation to the average horizontal illumination produced by an axial asymmetric fitting may be obtained as follows:—

In the case of an infinitely narrow street, the differentiation between an axial asymmetric and a symmetric fitting will no longer exist. If the width of the street is of the same order as the mounting height of the fitting, then beyond some point in the span (the distance of this point from the lamp depending on the degree of asymmetry of the fitting), the fitting may be considered symmetric as far as the horizontal illumination is concerned.

It follows, therefore, that the difference between axial asymmetric and symmetric fittings must be in the correction factor for street width, and the region in which the estimation of the horizontal illumination will be most affected is in that part of the span which is near to the lamp. It is suggested that this difference may be allowed for by modifying the formula for the average horizontal illumination so that Iv is no longer the vertical candle-power in the principal plane of the fitting, but the average candle-power over the range $\phi = O$ to $\phi = \eta$ in a plane at right angles to the principal plane, i.e., in a plane across the roadway. η is the angle between the vertical through the fitting and the direction joining the fitting to the point on the edge of the roadway which lies opposite the fitting.

Hue Wavelength of Neon Tubes

By B. S. COOPER and W. A. R. STOYLE

(*Research Laboratories of the General Electric Company Limited, Wembley*).

In view of the increasing use of illuminants of distinctive colour in situations where conspicuity is of primary importance, the determination of the hue of neon gas discharge tubes of various types becomes of interest. This information is now all the more necessary since it is desirable, for purposes such as aviation lighting, to have a classification and specification of the wavelength limits of such illuminants. The colour of this type of discharge tube renders it particularly suitable for danger signals (e.g., on obstructions) and for beacon purposes, and such tubes are being increasingly used.

As no data appear to be at present available, the authors have made a few provisional determinations. The light from the neon tube illuminated one of two photometric fields, while the other received light from a monochromatic illuminator. The tubes were run under various conditions, and the wavelength, which colour-matched the emitted light, was found by taking an average of several readings by three observers. Since the colour is fully saturated, no admixture of white is necessary.

Tests were made on neon discharge tubes of both the cold cathode and hot cathode types, and the following results were obtained:—

Type of Tube	Tube dia. in cms.	Current density	Hue Wavelength A.U.
Cold Cathode ..	1·5	20 milliamps/cm²	6,190
	1·1	26·5 "	6,170
Hot Cathode ..	2·2	0·53 amps/cm²	6,155
	3·5	0·62 "	6,140

It is evident from the above results that an increase of current density slightly reduces the hue wavelength. The experiments also indicated that this same effect was obtained by varying the current through any one tube.

The Lighting of Schools and Libraries

The reports on the above subjects, issued by subcommittees of the Technical Committee of the Illuminating Engineering Society, which appeared in our last issue*, have now been reprinted in pamphlet form. Copies may be obtained by anyone interested on application to the Hon. Secretary of the Illuminating Engineering Society (Mr. J. S. Dow, 32, Victoria Street, London, S.W.1).

* *The Illuminating Engineer,* July, 1931, pp. 155-161.

Literature on Lighting

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

(*Continued from page* 168, *July*, 1931.)

Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. H. M. Cotteril, Mr. J. S. Dow, Dr. S. English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. W. C. M. Whittle and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—ED.

I.—RADIATION AND GENERAL PHYSICS.

126. The Absorption Spectra Solutions of the Coloured Ions Cu, Cr, and Co. M. Kahanowicz and P. Orecchioni.

Zeits. fr. Physik, 68, *pp.* 126-132, 1931.

Extinction co-efficient curves of aqueous solutions of Ni, Cu, Cr and Co with respect to the wave-length of the light are given throughout the visible spectrum for decreasing concentrations of the solutions. The discussion of these curves leads to the confirmation of three well-defined phases in the absorption, viz.: (1) The molecular phase; (2) the phase of free ions; and (3) the phase of complex ions. The method gives a new test of the classical theory of progressive dissociation. T. H. H.

127. The Penetration of Radiation from Different Sources into Water and Body Tissues. W. E. Forsythe and Frances Christison.

Gen. El. Rev., 34, *pp.* 440-443, *July*, 1931.

Gives figures and curves for the spectral transmission of water and flesh, quoted in the main from other contributions, references to which are given.

G. H. W.

128. Extropolation to High Temperatures by Means of Absorbing Glasses and the Calibration of Disappearing Filament Optical Pyrometers for Different Wave-lengths. G. Ribauld.

Rev. d'Opt., X., *pp.* 168-177, 1931.

Gives a general discussion on the use of absorbing glasses in optical pyrometry, shows how an optical pyrometer calibrated with a glass of one colour can be used with a glass having a different colour.

H. B.

129. Spectral Transmission of the Absorbing Glass Jena 7839 in the Visible Spectrum. G. Ribauld.

Rev. d'Opt., X., *pp.* 162-167, 1931.

Gives the spectral transmission of this absorbing glass and discusses its use in optical pyrometry.

H. B.

II.—PHOTOMETRY.

130. A Precision Luxmeter, using Homochromatic Comparison Fields. P. Fleury.

Comptes Rendus, 192 *pp.*, 1715-1717. *June 29th*, 1931.

A high-precision luxmeter is described, using a blue-tinted glass wedge to eliminate colour differences, and a grey glass wedge to obtain intensity variation. Calibration curves are required. The apparatus includes a special optical system, and regulation of the lamp voltage by means of a Wheatstone bridge circuit. Measurements of the order of 1/100 lux can be made, and an accuracy of a few per cent. can be obtained with the instrument, which may also be used for colour pyrometry. S. S. B.

131. Objective Determination of Light Distribution Curves. Sewig.

Das Licht, 215, *May*, 1931.

The requirements for the satisfactory automatic plotting of light-distribution curves are enumerated, and then an apparatus embodying them is described. The apparatus consists of a photo-electric cell—an amplifier (mekapion) and a curve-drawing mechanism (rotating cylinder). S. E.

132. Photo-electric Cells and Light Measurement. Bloch.

Das Licht, 209, *May*, 1931.

A new type of cell (Sperrschichtzell) is mentioned, which is said to be an improvement on the alkali metal cell. Its sensitivity without amplification is 100×10^{-6} amps. per lumen as compared with 15×10^{-6} amps. per lumen for an alkali cell, also the galvanometer reading is practically proportional to the light intensity on the cell—a calibration correction is necessary only when the highest accuracy is desired. The spectral sensitivity curve is approximately the same as the eye sensitivity curve.

S. E.

III.—SOURCES OF LIGHT.

133. Construction and Use of Tungsten Filament Tubular Lamps. W. Starck.

Das Licht, 201, *May*, 1931.

Describes the construction of tubular lamps in which the filament is insulated from and held axially inside a spiral of molybdenum wire, which in turn is contained within a glass tube. These tubes may have diameters from 10 to 45 mm., and lengths up to 1 m. (for 220 volts). Standard length tubes of 1 metre may be made to consume from 80 to 180 watts. (They may be straight or bent into the form of letters.) S. E.

134. The Burning-out Process for "W" Filaments glowed in vacuo. L. Prasnik.

Zeits. fr. Physik, 69, *pp.* 832-834, 1931.

The phenomenon discovered by Fonda (*Gen. Elect. Rev.*, 32, pp. 206-212, 1929) that the total mass of "W" evaporated from the "W" filament during the course of its total life increases with the temperature of the filament is here dealt with theoretically, and found to be due to the fact that the susceptibility of the filament life to faults in the filament decreases with rise of temperature.

T. H. H.

135. On the Theory of the Mercury Arc. K. T. Crompton.

Phys. Rev., 37, *pp.* 1077-1090, 1931.

Too complex for abstraction. The paper points out the causes of present limitation in our knowledge of conditions at the cathode and the manner and extent to which these limitations may be removed. H. B.

136. Actual State of our Knowledge of the Low-pressure Mercury Arc. M. Leblanc and M. Demontvignier.

R. G. E., 29, pp. 935-950, *June 13th*, 1931.

A continuation of Abstr. 104. Phenomena occurring at the two electrodes on the low-pressure mercury discharge are described and expressions derived. Various phases of the positive column are studied. Applications of the results are given.

W. C. M. W.

IV.—LIGHTING EQUIPMENT.

137. The Adjustment of Motor-car Headlights. J. Dourgnon and P. Waguet.

R.G.E., 29, *pp*. 931-935, *June 13th*, 1931.

Discusses the requirements of motor car headlights for main-road and secondary-road driving. Discusses the production of dazzle-effects from two different types of beam and gives light-distribution data. Recommends three types of beam and gives application of each type. W. C. M. W.

138. Irregularities in the Profile of Reflectors for Automobile Headlights, and their Photographic Investigation. P. Waguet, A. Stampa, and J. Dourgnon.

Comptes Rendus, 192, *pp*. 1,549-1,550, *June 15th*, 1931.

Two methods are described for investigation of the departure of the profile of a deep reflector from a true parabola (the irregularities being assumed symmetrical about the axis) by determining the focus of each element of the profile and recording its position photographically. S. S. B.

V.—APPLICATIONS OF LIGHT.

139. Observations on the Question of the Vertical and Horizontal Illumination of Streets from the Motorist's Point of View. N. Oglobin.

Das Licht, 198, *May*, 1931.

After a discussion of the characteristics of various types of street lighting from the motorist's point of view the following preferences are indicated: Horizontal illumination appears better than vertical illumination, and since the eye accommodates itself to the brightest areas in the field of view, the inequality ratio should not be greater than 3 or 5 to 1. Glare is not to be measured by the intensity of the light rays in any particular direction, since the general illumination of the street has a counteracting effect. A unit which would produce glare in a badly lit street might be perfectly free from glare in a well-lit thoroughfare. S. E.

140. Street Lighting and Traffic Accidents. K. M. Ried.

El. World, 97, *pp*. 1,186-8, *June 20th*, 1931.

Suggests a method of measuring the efficiency of street lighting in terms of the ratio of night-accidents to day-accidents. Gives an analysis of the accidents occurring in Cleveland, Ohio, by this method, and a similar analysis for the State roads of Indiana.

W. C. M. W.

141. Commission for Lighting Glassware: Report of the Joint Committee of the German Society of Glass Technology and the German Society for Illumination Technology, 1930-31.

Glastech. Berichte, 354, *June*, 1931.

This joint committee has had under consideration, and reported on, the following topics: I, Opal and matt glasses—from the point of view of lighting technique; II, Definition of the diffusive power of opal and matt glasses; III, Classification of opal glasses—for illumination purposes; IV, Classification of matt glasses for illumination purposes; V, Work for the International Illumination Commission. S. E.

142. Typical Brightness Contrasts in the Industrial Field. M. Luckiesh.

Licht, *p*. 34, *Summer*, 1931,

By comparing the reflection-factors of objects with those of backgrounds the brightness contrast of any combination can be found. Typical examples are given in tabular form. C. A. M.

143. Better Lighting for Older Eyes. F. K. Moss.

Light, *p*. 34, *May*, 1931.

Data are given on the relation of power of accommodation to age. The decreased visibility due to the recession of the "near point" with increasing age, may be offset by the increase of illumination. A scale of foot-candles and distances for equal visibility is given. C. A. M.

144. New Lighting Schemes in Austria. Anon.

E. u. M. Licht, 8, *pp*. 25-28, *June*, 1931.

Gives photographs and descriptions of schemes of interior and exterior lighting—e.g., signs, shop-fronts, restaurants, etc. G. H. W.

145. The World's Highest Building by Night. Anon.

Elect., 106, *p*. 907, *June 19th*, 1931.

A night photograph is given of the Empire State Building in New York upon the tower of which words are projected from another skyscraper in the vicinity. C. A. M.

146. The Illumination of Gas-service Stations. R. J. Swackhamer.

Gen. El. Rev., 34, *pp*. 425-430, *July*, 1931.

Outlines the latest practice recommended for the lighting of petrol filling stations. The requirements are stated in detail and installations and equipment are described. G. H. W.

147. Direction Signal. W. E. Clemson and H. G. Schiller.

Light, *p*. 33, *May*, 1931.

Gives a photograph and short description of a luminous direction signal, showing "left," "right," and "stop" indications attached to the front and back of a motor car and controlled from the steering column and brake. C. A. M.

148. Fifty Foot-candles. J. W. Fleming.

Light, *p*. 13, *Summer*, 1931.

Details are given of the lighting equipment of a store in Buffalo where an indirect illumination of 50 foot-candles is provided. C. A. M.

149. The Employment of Visible and Invisible Radiation (especially infra red rays) for Transmission of News and for Devices to Aid Traffic Safety. G. Gresky.

Phys. Zeits, 32, *pp*. 193-212, 1931.

This paper gives an exhaustive account of that form of telegraphy or telephony in which the messages are transmitted through the agency of a strong beam of light or infra red radiation. It discusses the wave-length regions employed and the methods of production of the beams of radiation, the means of detecting the radiation, and the problems with respect to the propagation of the beams especially with regard to the influence of atmospheric conditions. It deals with various kinds of modulation of the transmitter and with the various methods of reception of the modulated radiation — photo-electric cells, selenium cells, thermopiles, bolometers, etc. The range of working of various systems is discussed. Variations of this type of apparatus are mentioned which may be usefully employed for assisting in the navigation of ships and aeroplanes, in the guarding of harbour entrances and for operating burglar alarms. The advantages of infra red rays lie in their invisibility and in their power to penetrate through fog.

T. H. H.

VI.—MISCELLANEOUS.

150. Reflectance Measurements in the Paint Industry. G. F. A. Stutz.

J. Opt. Soc. Am., 21, *pp.* 323-335, 1931.

Gives a description of the methods of specifying the optical properties of paints and the maintenance of uniformity therein adopted by the leading paint manufacturers. The spectrometer is becoming more widely used in defining the colours of paints. Three factors are sufficient to specify the appearance of a painted surface with sufficient exactness for practical purposes, viz.: (1) The amount of spectral distribution of the diffusely reflected light; (2) the amount of specularly reflected light (the gloss); (3) the total (integrated) reflectance.

The problem as to whether a high-gloss paint possesses a greater lighting efficiency than a matt paint of the same total reflectance, or *vice-versâ*, is raised. T. H. H.

151. A Photo-electric Integraph. T. S. Gray.

Journ. Fr. Inst., 212, *pp.* 77-102, 1931.

Describes a photo-electric apparatus for the performance of mathematical calculations requiring the evolution of certain types of integral. It involves the use of an optical system in which the transmission of light is limited by apertures having a shape as that of the curves representing mathematical functions. Examples of its use are given. H. B.

152. Photocell Theory and Practice. V. K. Zworyken.

Journ. Fr. Inst., 212, *pp.* 1-42, 1931.

Gives a general account of the history, method of preparation and application of photo-electric cells. H. B.

153. A Photo-electric Spectrophotometer for Measuring the Amount of Atmospheric Ozone. G. M. B. Dobson.

Proc. Phys. Soc., Lond., 43, *pp.* 324-338, 1931.

A photo-electric spectrophotometer is used in which the relative intensities of two spectral lines in the ultra-violet can easily and quickly be measured. If one of these two lines is absorbed and the other is not absorbed by ozone, the relative intensities of these is a measure of the amount of ozone present in the atmosphere. It is shown how the amount of ozone can still be measured even when the sky is cloudy, if a second pair of wave-lengths both unabsorbed by ozone are also measured. T. H. H.

154. Quartz Double-Monochromators. C. Leiss.

Zeits. fr. Physik., 69, *pp.* 678-685, 1931.

Those quartz double-monochromators in which simple lenses are used as objectives which are focussed automatically with the turning of the dispersion sytem are still beset with small errors which up to now have been difficult to deal with. After discussion of these faults, it is shown how each one can be avoided. Useful diagrams are given. T. H. H.

155. The Reflecting Powers of Rough Surfaces at Solar Wave-lengths. H. E. Beckett.

Proc. Phys. Soc., Lond., 43, *pp.* 227-241, 1931.

The diffuse reflecting powers at wave-lengths between 500 and 1,780 $m\mu$ and also for total sunlight of many rough surfaces of building materials, such as clay tiles, slates, sundry roofing materials and bricks, are given. The method used in obtaining these is an interesting one, a thermopile being used as the detector of the reflected radiation, which being diffuse is collected with a large hemispherical mirror before reaching the thermopile. A pointolite lamp used with a screen of thin gold film was found to give a wave-length distribution reasonably similar to that of sunlight. T. H. H.

156. The Physical Properties of Glass in Relation to its Composition. The Influence of the Most Important Constituents on the Clouding of Silica Glasses by Addition of Fluoride. G. Gehlhoff, H. Kalsing, and M. Thomas.

Zeits. f. Techn. Physik., 12, *No.* 7, pp. 323-344.

Description of extensive experiments to determine the clouding effects of individual constituents of glass in varying proportions, and also of temperature and time of founding. Plates of different compositions were made and their reflection and absorption measured. The number of diffusing particles and their cross-section was determined for thin sections of part of the melt. Numerous curves are given of the relation between the constituents and the physical properties. E. S. B.-S.

157. Diffusely Transmitting Media for Ultra-violet Radiation. M. Luckeish.

Elec. World, 97, *pp.* 1,232-3, *June 27th*, 1931.

Diffusing quartz is not so efficient for transmitting ultra-violet light as might be anticipated. Measurements of the transmissions of "Vitreosil" and "Corex D" glass have been made, using a Mazda S.1 lamp and a blue fluorescing attachment to a Macbeth Illuminometer. A table connecting thickness, transmission for diffused (white) light, and transmission for ultra-violet light is given for the two media. W. C. M. W.

158. Investigations on an Erythema Meter. A. Dresler.

Licht u. Lampe, 20, *pp.* 207-209, *June 25th*, 1931.

The Weyde Erythema-dosimeter employs a solution of leucosulphite of crystal-violet which becomes blue under the influence of the ultra-violet radiation. Results are given of measurements on the radiation from three types of ultra-violet lamps by means of this instrument. G. H. W.

159. On the Conversion of Luminous Intensities into Sound Intensities. Georges Fournier.

Comptes Rendus, 192, *pp.* 1,547-1,548, *June 15th*, 1931.

A copper-oxide photo-electric cell is used to operate a telephone receiver, without amplification of the current. The apparatus should be of use to the blind, tests (of which details are given) having shown good sensitivity. S. S. B.

Lighting Research at the National Physical Laboratory

There is apt to be an impression that the activities of the National Physical Laboratory in connection with lighting are exclusively "photometric." An informative survey of lighting research at the N.P.L. contributed by Dr. John W. T. Walsh to *The Gas Journal* (June 24th) should remove this impression.

The manner in which the work of the Illumination Research Committee of the Department of Scientific and Industrial Research, the Medical Research Council, and the section of the British Engineering Standards Association dealing with illumination are interlinked with the National Physical Laboratory is here well illustrated. The photometric equipment of the laboratory, including such items as the 10-ft. integrating sphere and the photo-electric recording of daylight, are briefly described, but reference is also made to such matters as research on glare, the brightness of diffusing glassware, and the effect of illumination on the ease with which fine work can be performed.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety— Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)

The E.L.M.A. Exhibition Stand at the I.M.E.A. Convention

(Communicated.)

CONSIDERABLE interest was shown in the stand of the Electric Lamp Manufacturers' Association at the Exhibition held in conjunction with the I.M.E.A. Convention at Scarborough some little time ago. It was designed to deal with two main features of lighting development, namely, electric lamps and lighting service.

The exhibit, covering a floor area of 400 square feet, was designed on distinctly modern lines by Mr. R. W. Maitland, A.R.I.B.A., Architect of the Lighting Service Bureau, who succeeded in producing a functional stand combining simplicity with utility. The stand was constructed of Plymax, with nickel-plated columns, and was of a pink colour, with bands of greenish blue.

The most striking feature of the exhibit was the 20-foot tower, studded on three sides with pearl, opal and coloured lamps. These ranged from 100 to 40 watts, and flashed continuously in a regular sequence. This, surmounted by an illuminated cone of stainless steel, attracted the attention of everyone who entered the building. On the fourth side of the tower was a list of the brand names of E.L.M.A. lamps, and a statement emphasizing their high quality, and pointing out that this was only possible on account of the vast experience and continual research of members extending over a period of more than 20 years.

The stand itself was divided into four portions, two of which were devoted to lighting demonstrations. The importance of every supply undertaking providing lighting service was emphasized.

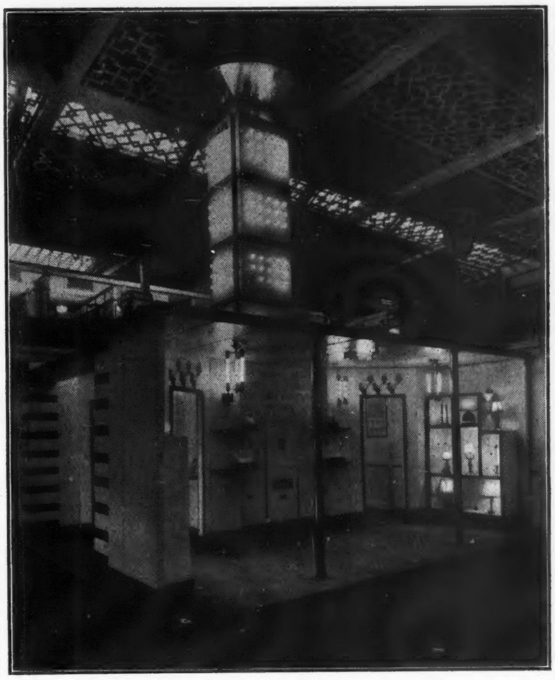
Numerous examples of the latest domestic lighting fittings and artistic features with which the home can be furnished were arranged in one section, special emphasis being given to the importance of providing sufficient plug points in the home.

In another section prominence was given to such convenient lighting in the home as the provision of luminous shaving mirrors and illuminated house signs.

Built into the base of the tower the familiar E.L.M.A. lamp display appeared in a new form, enabling visitors to see at a glance the number of hours for which any lamp can be used for one unit of electricity.

The whole exhibit was designed to show the public what types of lamps and fittings are most suitable for various domestic purposes and to demonstrate that efficient, glareless lighting is essential in the home—in short, to educate them to a proper appreciation of the importance of, and the necessity for, good lighting.

The exhibit as a whole is available to a limited number of supply undertakings for local exhibitions. Judging by the interest shown in it by electrical men at Scarborough, it is likely that it will be in some demand during the next twelve months.



Inadequate Lighting in Hotels

In the course of a recent Conference arranged at the E.L.M.A. Lighting Service Bureau various suggestions in regard to lighting developments were made. Mr. W. J. Jones pointed out one obvious opportunity—the development of illuminated facias, which furnish an excellent advertisement, and yet are still strangely neglected by many stores. A recent survey has shown that only 1 per cent. of shops are thus equipped, and at the present time only 7 per cent. make use of illuminated signs of any kind. Another important topic, raised by Mr. Sully, was the lighting of hotel bedrooms—many of which are still furnished with only a single lamp. (We hope and trust that the hotels visited by members of the I.C. will not give offence in this respect!)

Seaside Resorts are Using More Light

The municipal authorities of a large number of our seaside towns have realized the tremendous value of good lighting as an attraction to visitors during the summer months. Floodlighting in particular has been enlisted as an asset to many of the most popular of our coast resorts, and has done much to enhance the value of both the artificial amenities and entertainment facilities of these places.

Two good examples of the use of floodlighting for this purpose are to be found in the illumination of the Palace Pier, Brighton (see Fig. 1) and of the St. Lawrence Cliff and Bandstand, Ramsgate (see Fig. 2). The former, which has recently been completed, employs forty-four weatherproof "Mirolux" trough reflectors specially adapted for the purpose, while the latter installation, which has

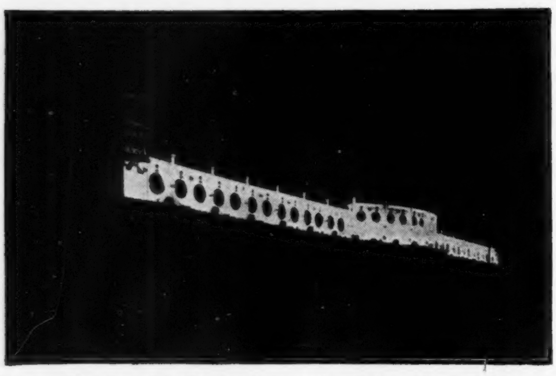


FIG. 1.—Showing the illumination of the Palace Pier, Brighton.

attracted great interest and much favourable comment, consists of eighteen large Ediswan floodlight projectors, located on the roof of the pavilion, which flood the arena; and inverted rectangular "Mazdalux" projectors at the base of the stand, which floodlight the elevation of this structure.

In this connection the attention of municipal authorities should be drawn to the facilities offered by the important manufacturers of lighting equipment in drawing up complete schemes, and making recommendations free of charge. As an instance of this, both the above installations were designed and supervised by the Illuminating Engineering Department of the Edison Swan Electric Co. Ltd., for the local authorities concerned, and Ediswan equipment and Royal Ediswan lamps were employed. Other public bodies should take advantage of the service offered.

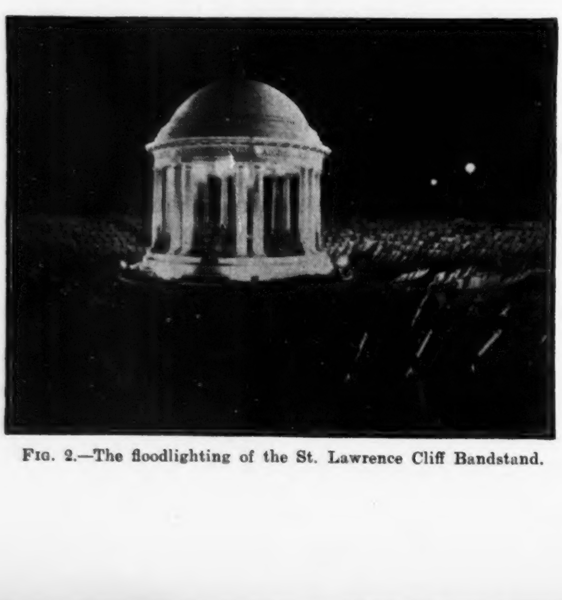


FIG. 2.—The floodlighting of the St. Lawrence Cliff Bandstand.

Ideal Homes for Scotland

We notice that Scotland is to have its own Ideal Home Exhibition, which will be held in the Kelvin Hall, Glasgow, from September 30th to October 24th. This is a development of the Housing and Health Exhibition held annually under the auspices of the Glasgow Corporation, which is stated to have attracted, during recent years, an average of more than a quarter of a million visitors.

There is to be an "All Scottish" Ideal Home, representing the designs of the winner of a competition for Scottish architects. "Rooms Famous in Scottish History," an exhibition of works of art under the title of the "Sons of Glasgow" Art Gallery, and a self-contained and fully equipped "Theatre of Fashion" with a seating capacity of 1,600, are other attractive items of the programme, which will also include a series of one-room ideal homes, a model farm, ideal nurseries, etc.

The Ideal Home Exhibition in London has almost invariably served as an opportunity for demonstrations of original and up-to-date methods of lighting, and we hope that at the Scottish Ideal Home Exhibition the opportunity of demonstrating the possibilities of domestic lighting will be fully utilized.

Change of Addresses

The General Electric Co. Ltd. inform us that the address of the Hull Branch, on and after August 1st, will be Magnet House, 164-166-168, George Street, Hull. The telephone numbers have been changed to Hull 34625 and 34626.

Straight-Lite-Reflectors Ltd. announce that their *only* address is now 73, Canonbury Road, London, N.1, where larger premises have been secured.

Sheffield Illumination Society

On Saturday, June 20th, about 90 members and friends of the Sheffield Illumination Society made a circular tour to Buxton and Matlock for their annual excursion. The journey was a very pleasant one, the weather being particularly good. About four hours were spent in Buxton, giving plenty of time to visit the beautiful gardens and taste the famous water, etc. Buxton was left behind and Matlock reached about 3-45, where tea was served. After having a short look round, the party left for home at 6-45 p.m., having had a most enjoyable outing.

Characteristics of the Modern Incandescent Lamp

In a paper on the above subject recently read before the Association of Supervising Electricians, Mr. L. E. Buckell gave an informative survey of the processes involved in the construction of the modern electric lamp. There can surely be few products in common use that involve a greater number of diverse processes, and perhaps this is not sufficiently considered by those who grumble that the price is too high! Mr. Buckell mentioned incidentally that in the last ten years the price of the smaller lamp has come down from 3s. 9d. to 1s. 10d., a reduction of nearly 55 per cent., whilst the 60-watt lamp has come down still more (from 7s. 6d. to 1s. 10d.). In view of the 30-odd tests applied to each lamp in the course of manufacture, a wastage of not more than 6 per cent. is certainly creditable. Even this, one imagines, might be diminished if lamp makers could count on greater uniformity of declared pressures. There is, however, a prospect of steady improvement in this respect.

The Design of Gas Lighting Fittings

The *Gas Engineer* has been criticizing the design of some of the gas lighting fittings to be seen in showrooms, and these remarks have aroused comment by a number of manufacturers. Complaint is made that some gas undertakings are insufficiently progressive in showing the latest types of fittings and give the public a poor impression of what modern gas lighting can do. On the other hand, one still finds occasionally—both amongst supply undertakings and manufacturers—an impression that they must provide what the public asks for, and the public is notoriously conservative in such matters. It is, we believe, a fact that there is a class of consumer who continues to demand the lighting equipment of a generation ago, but it would be fatal for an industry to be guided by his views. The astonishing success which has attended the introduction of the so-called "modernistic" or "architectural lighting types" of electric fittings shows what can be done by enterprise and educational effort in the way of inducing people to accept highly modern designs.

Modern Street Lighting by Gas

(*Communicated.*)

THERE is much misconception amongst the general public regarding the important part that gas is playing in the lighting of public streets. In this country the greater part of the streets are lighted by gas. A recent census of 318 towns showed that there were 13,341 miles of streets so lighted. There are in the London area nearly 100,000 gas lamps, and the majority of the important streets are lighted by gas—Whitehall, Regent Street, half Piccadilly, St. James's Street, Trafalgar Square, Pall Mall, Bayswater Road, Tottenham Court Road, Kensington Road, Victoria Street, Cannon Street—to mention a few. The West End and the City are served by a high-pressure network which has been working for some twenty years without a single failure in the general supply of gas. The high standard of London gas lighting is largely due to the efficiency of the maintenance services operated by the various companies concerned. In the great majority of cases each lamp is inspected once a day after lighting-up time, and this ensures immediate adjustments or replacements—a great improvement on the old haphazard system by which occasional police reports were the only indications of failures.

and Fulham Road, Chelsea, and an example of the latter is to be found in Bayswater Road. In every case mounting heights are being increased, a necessary development in view of the larger size of the units. The annual saving to the Chelsea Borough resulting from this installation will be £200 for the first few years, and £400 afterwards. Yet the new system is far more effective than the old one. In general, the size of reflectors is increasing, and experiments are being made with stainless steel; enamelled steel, however, continues in general use. Frosted globes are becoming more popular, and stainless steel directional reflectors are more in evidence. Refracting glass plates in conjunction with line burners are coming to the front, especially where square lanterns are concerned, and have resulted in much improved "diversity factors."

In South London there has recently been a considerable increase in the use of centrally suspended high-pressure lighting. Following on the successful tests at Lewisham, where short stretches of road were lighted by various systems, it was decided to adopt centrally suspended high-pressure gas lighting for a large number of main roads in this part

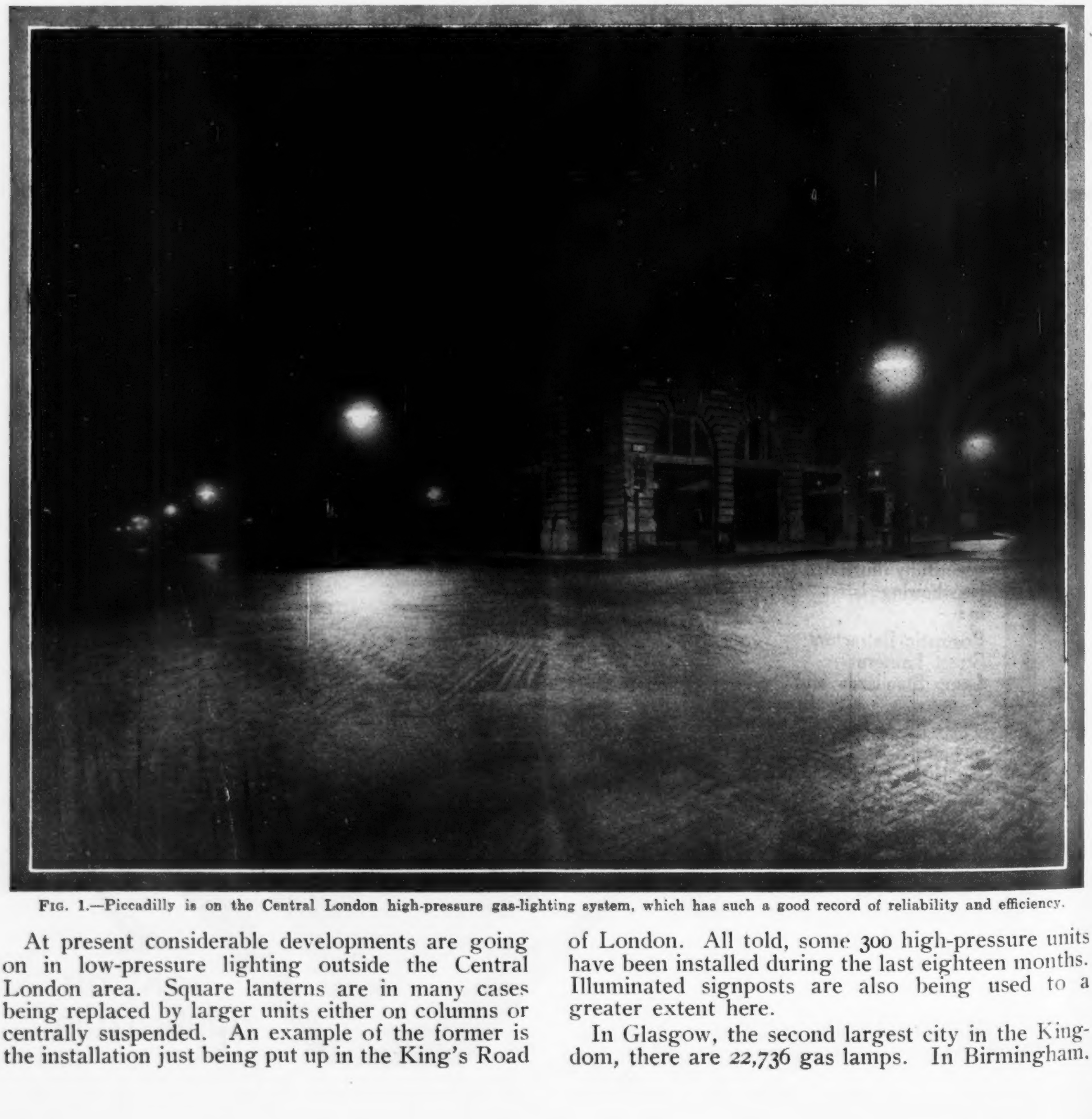


FIG. 1.—Piccadilly is on the Central London high-pressure gas-lighting system, which has such a good record of reliability and efficiency.

At present considerable developments are going on in low-pressure lighting outside the Central London area. Square lanterns are in many cases being replaced by larger units either on columns or centrally suspended. An example of the former is the installation just being put up in the King's Road

of London. All told, some 300 high-pressure units have been installed during the last eighteen months. Illuminated signposts are also being used to a greater extent here.

In Glasgow, the second largest city in the Kingdom, there are 22,736 gas lamps. In Birmingham.

the third largest, there are 655 miles of road lighted by gas. In the centre of the city there is a high-pressure lighting system which includes Victoria Square and Paradise Street, both of which come into Class "A" of the B.E.S.A. street-lighting specification (i.e., average test-point illumination greater than 2 foot-candles). This altogether exceptionally high standard of illumination is achieved by the use of three-light high-pressure lamps of 4,500 candle-power each. Besides the high-pressure lighting in Birmingham there are a number of excellent examples of low-pressure lighting, of which Hagley Road is one. This road is divided into short stretches, each lighted by a different system. The illustration shows a new centrally suspended system with a special gear by means of which the lamp is swung over the pavement and at the same time lowered without interrupting the gas supply. All the lamps in Birmingham are clock-controlled.

In Coventry, too, gas lighting is receiving some of the support it deserves. Before deciding what lighting system to adopt in Corporation Street, the Watch and General Works Committee called for reports from the Gas and Electricity Departments and sent a deputation to London to inspect some installations there. As a result of their deliberations they decided unanimously to adopt high-pressure gas.

FIG. 2.—Bayswater Road, where a centrally suspended low-pressure system has recently been installed and is proving very successful.

FIG. 4.—Victoria Square, Birmingham, whose brilliant illumination by 4,500 c.p. high-presure lamps brings it into Class A of the B.E.S.A. specification.

FIG. 3.—Bromley Road, London, where centrally suspended high-pressure lighting has just been installed.

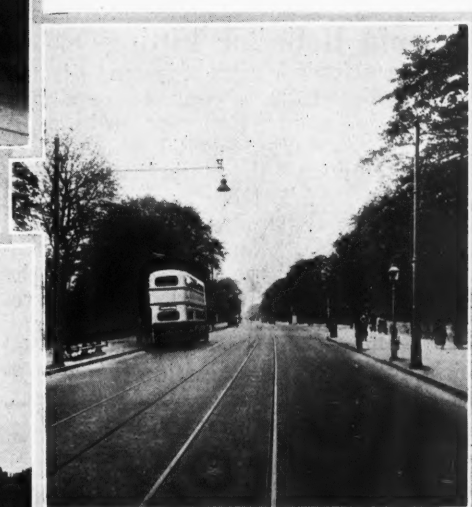


FIG. 5.—The centrally suspended low-pressure installation in Hagley Road, Birmingham. The special lowering device simplifies maintenance considerably.

FIG. 6.—Corporation Street, Coventry, where high-pressure gas lighting has recently been installed on ornamental columns.

While some of the street lighting in this country is excellent, there is a great deal which is unpardonable. Old-fashioned lighting is both expensive in running costs and in the accidents it causes. The sooner it can be replaced by modern lighting the better for all concerned. Modernizing an existing gas installation is not a very expensive business, and is far cheaper than installing a new system altogether. Moreover, examples such as are here shown prove how efficient a modern gas installation is from the point of view of quality, as well as cost and reliability.

TRADE NOTES & ANNOUNCEMENTS

Keats' Home Floodlighted

On the occasion of the opening by the Marquis of Crewe, on July 16th, of the Keats museum and Library at Hampstead, the poet's old home, which adjoins the new museum, was most effectively floodlighted by means of Mazda lamps. The famous mulberry tree in the garden, where Keats wrote the "Ode to a Nightingale," was also subjected to the benign influence of Mazda lighting.

The accompanying illustration gives a good idea of the effect obtained. One wonders what Keats himself would have thought of the project. People sometimes assume that the floodlighting of any place of historic interest is vandalism, but we are inclined to think that poets are more susceptible to new impressions than some of their admirers. It is quite likely that Keats—whose work showed a keen and sensitive appreciation of light effects in nature—would have been alive to the romance of artificial light and an admirer of the wonderful effects that can be produced thereby.

View showing the Floodlighting of Keats' House in Hampstead, on July 16th.

Benjamin Reflector Fittings

We have received from Messrs. Siemens Electric Lamps and Supplies Ltd. a copy of catalogue No. 429, listing "Benjamin" Reflector Fittings. A leading feature is, of course, the R-L-M one-piece design, but other familiar "Benjamin" specialities, such as the "Glassteel" Diffuser Fittings, the "Biflector" types, and parabolic angle types of steel reflectors are shown. Amongst recently introduced varieties we may mention specially the "Visor" enclosed dustproof and daylight reflectors, and the compact "Projectolux" and "Intensolux" designs, which seem to meet special cases in which strong local illumination is required.

CONTRACTS CLOSED.

The following contracts are announced:—

THE BRITISH THOMSON-HOUSTON CO. LTD.:

The Port of London Authority; for three months' supply of Mazda vacuum and gasfilled lamps.

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD.:

Union Castle Mail Steamship Co. Ltd.; for supply of Siemens vacuum and gasfilled lamps.

Royal Mail Steam Packet Co.; for a year's supply of Siemens electric lamps.

Belfast City Tramways; for the supply of Siemens electric lamps for nine months.

British General Post Office; repeat contract for supply of several thousand Siemens lamps for inspection headlamps.

His Majesty's Office of Works, Whitehall; for twelve months' supply of Siemens gasfilled and vacuum lamps.

Metropolitan Water Board; repeat contract for the supply of Siemens gasfilled lamps for twelve months.

INDEX (August, 1931).